# SCIENTIFIC AMERICAN

DESTROYING A RIGID DIRIGIBLE WITH AERIAL MINES.

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# SCIENTIFIC AMERICAN

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*The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.*


## The War and Our Dilemma

IT is very difficult for the American to realize that the great European war, which has been dreaded for a generation, is actually taking place. The calamity is so appalling that it seems to stretch beyond the reach of the imagination. The desire of the President, although impotent, to avert hostilities is voiced in every American breast. It was useless to offer mediation—there was no question to mediate. There was only the gaunt figure of brute force against brute force.

After the great wave of distress for the terrible calamity which has befallen Europe has been expressed, the thought naturally turns upon what will be the effect of such an upheaval upon our own country, and what lesson can we learn from it. For years the SCIENTIFIC AMERICAN has preached the necessity of the upbuilding of our merchant marine. The story of our present poverty in merchant ships is too well known to need mention at the present time, but now, at last, the lesson is driven home in a surprising and unexpected way. Some two hundred thousand Americans are practically marooned in Europe with no facilities for reaching their country. Battleships and cruisers, even were it practicable to put our line of defense to such a use, are not adapted in any way to passenger service, and such a method of solving the problem is almost out of the question. Of navy transports, we have hardly any. The International Mercantile Marine, owned as it is largely by American capital, does not carry the Stars and Stripes, and under the terms of the purchase its larger ships may be used by the British government, whose flag it flies, under stress of war conditions. It has been said that the United Fruit Company has placed its small fleet of steamers at the disposal of the Government for the rescue of Americans stranded abroad. It is humiliating to think that the Government may be obliged to apply to private owners for the use of their vessels to aid in the present crisis. The American Line is the only transatlantic line which flies the Stars and Stripes. In recent statistics published in London, it was stated that the wealth of the United States at the present moment was almost equal to the combined wealth of Great Britain and Germany. In spite of this, owing to bad laws, lack of support on the part of the Government, and the high cost of labor, we are not able to compete with the merchant marine of other nations. We are paying enormous sums every year to foreign owners for the transportation of our imports and exports. This large sum might be kept in this country provided we had seriously entered into the field of marine competition. Experience has shown that we are capable of building as good ships of war as other nations, but we have allowed our domestic ship building to fall into decay. Now that the period of great railroad construction has been arrested, largely through the hostile legislation of the Federal and State governments, there are plenty of men with which not only to build our vessels, but to provide personnel.

It is fortunate that we have received this sinister warning at a time when we are at peace with all the world. Had we found ourselves in a serious war, the utter lack of a merchant marine, both for commerce and transports, would be a calamity for which we would dearly pay. The price now is one largely of pride and lost opportunity.

The lost opportunity will present itself a little later when our merchants are seeking an outlet for their foreign exports. Our trade with Europe has, of course, fallen into utter confusion, and will, to a great extent, be terminated. The trade between Europe and South America will be practically interrupted. We fortunately have reached a psychological moment for developing our trade with South America. Never before has there existed so cordial a relationship between the two continents. Whatever trouble may have arisen from the Mexican imbroglio, it has served one great purpose. It has brought the great republics of the South and ourselves to a better understanding, and the conferences of the A. B. C. envoys have served to show that our interests, both in humanity and in commercial development, are mutual.

It is possible for us to supply South America with most of the goods they have been importing from Europe. They are in a position to greatly increase their exportations to this country. Now is the time for our manufacturers and merchants to direct all of their energies toward cultivating trade relationship with our neighbors. They should adapt themselves to their wants and their methods of doing business; they should know their language and be prepared to correspond in the tongue of the country; their salesmen should be men of good manners and be able to converse in foreign languages. But above all we should be in a position to carry our goods in our own vessels and under our own flag. Let this government give some encouragement to the upbuilding of our mercantile marine by wise laws and we shall resume the position on the high seas which we occupied before the time of the civil war.

The present occupant of the White House is eminently qualified to carry out this work. The new tariff law and the currency bill no longer require his attention. The tension of the Mexican situation has been relaxed, the country realizes that the great need at the present time is the upbuilding of our marine. Especially is this so with the approaching opening of the Panama Canal. The recent conferences held in Washington, the object of which was to pass more liberal laws as regards the flag, indicate that the situation and the need of a better condition of affairs are at last understood there, and with a determined Executive it is to be hoped that at last the way will be opened for a new field of industrial usefulness.

## The Napoleon of the Twentieth Century

CHIEF among the many dramatic features of the opening scenes of the great European war drama, is the superb daring with which the German "War Lord" has launched his mighty army against what is practically the united naval and military strength of the rest of Europe.

For the neutrality of Italy has withdrawn from the Triple Alliance a great army and a powerful navy of the most modern type. This defection leaves the Mediterranean Sea so completely in the control of the Triple Entente, that the Austrian fleet will probably never venture forth from the protection of its naval base. The Austrian army has yet to win its laurels; for, as every student of history knows, the military history of Austria has been marked more by defeat than victory. With Russia's army of triple her own strength to the north, and with the warlike Servians and a doubtful Italy to the south, Austria will be so closely concerned with her own defense, as to be able to render but limited assistance in the immediate field of operations covered by the German armies.

Upon Germany, then, will fall the stupendous task of inflicting a decisive defeat upon the combined armies of France, Russia, Great Britain, Belgium and Holland, and as seems not unlikely, of Denmark also.

And, as if this were not enough, Germany has boldly flung the gauntlet in the face of the greatest naval power the world has ever seen—a power as pre-eminent upon the Seven Seas as is her own matchless army upon the battleground of Europe.

The hope of success for Germany depends upon the quick accomplishment of two stupendous results: First, a defeat of the combined British and French fleets so overwhelming as to give to Germany the complete control of the sea; and second, the launching of the flower of her army against the French in an attack so swift in movement and so overwhelming in numbers, as to crumple up and break through the defense, and enable the German army to repeat the triumph of 1870, and march as conquerors through the boulevards of Paris! This would leave her free to strike with a like swiftness and concentration at Russia; and with the diversion produced by an Austrian advance into Russia to the eastward, she would seek to fight her way resistlessly through the Russian defense and capture St. Petersburg.

But to swiftly concentrate an army of the enormous size necessary for an overwhelming defeat of the French defense, it was necessary to violate the neutrality of a friendly nation, and, so, to the calamity of the Italian defection has been added the burden of a war with the combined forces of Great Britain, Belgium, and Holland.

It is this complication that seems to spell the ultimate overthrow of the greatest and most efficient military organization the world has ever seen. For if, as is probable, the German fleet is crushed or driven under the shelter of its seacoast fortifications, and shut up there for the rest of the war, Germany will be so absolutely blockaded that not a pound of foodstuff will find its way into her dominions. She is not self-supporting, and Austria will be hard put to it to feed her own armies and people.

The Triple Entente, on the other hand, having command of the sea, will be able to call upon the markets of the world for supplies.

But the embroilment of Great Britain and her allies, Belgium and Holland, will have a military—a strategic—effect, that will go far to defeat the Emperor's Napoleonic dream of crushing the allies in detail by an irresistible initiative. Great Britain, with the German fleet either crushed or blockaded, will be free to land at once 250,000 men in Belgium and Holland. These troops, combined with the mobilized armies of Belgium and Holland, will constitute a total of nearly 1,000,000 men, capable of being driven like a wedge across the lines of communication of the German invasion of France. With such a diversion threatening its flank and rear, the pressure upon France would be relieved. By the time the British-Belgian-Holland flanking movement is in full swing, the Russian army corps will have moved down to confront Germany upon her eastern frontiers, and it may well happen that Germany's vigorous offensive will have to give way to a defensive fight for her very existence.

Not since wars began has so great a military people, with such a sublime confidence in its invincible prowess, played for so great a stake as that for which the German hosts are now battling on sea and land.

Should the Teuton win, he will hold all Europe in his "mailed fist," and the flag of his ships of war and commerce will float undisputed upon the Seven Seas, with nothing to stand between him and world-wide dominence but the great English-speaking republic of the New World!

Should Germany, in spite of her stupendous heroism, go down to absolute and crushing defeat on land and sea, the terms of peace may involve as a guarantee of peace by preventing the upbuilding of another such vast military organization, the break-up of the German Confederation, and Germany's magnificent naval and commercial fleets, to say nothing of her foreign colonies, will have been wiped off the face of the earth.

Had Germany shown a less ruthless spirit in flinging herself against the rest of Europe in a defiance so bold as to appear almost contemptuous, she might hope, in the event of disaster, for reasonable terms in the great final accounting. As it is, Europe, if victorious, will take a heavy toll.

## Fighting in the Air

THE meager reports of actual engagements in the fateful war include the account of a Zeppelin rammed by an aeroplane said to have been a small racing monoplane piloted by the famous "looper" Garros. Garros turned up alive, thus disposing of his share in a dramatic adventure, and the feat is now attributed to a more obscure pilot. The story can hardly be credited, in view of the secrecy maintained on all sides. Such tales as this of the Zeppelin, said to have been attached to a German column crossing the frontier, are unmistakably inventions, as only aeroplanes would be employed in such a rôle.

At the recent competition at Vienna most of the French participants were "loopers" on light powerful monoplanes. One among their number carried off the prize offered for describing a figure 8 of the smallest diameter possible. During the same meet an Austrian aeroplane and dirigible were both destroyed, near Vienna, in an explosion following a collision. Garros, who was there, must have known that ramming a dirigible was like holding a burning candle to gunpowder. So the story that he deliberately sacrificed himself is given plausibility.

Against small machines artillery seems efficient only while the dirigible is running away at top speed. The utmost care in watching for them (fortunately they are very noisy), followed by clever steering, is absolutely vital. In the limitless air even a fleeing dirigible is not necessarily driven from its course. It can take to flight in a wide detour, if the racer is sighted at a sufficient distance; if it is compelled instead to turn back in its tracks, the question whether the monoplane will be hit, before it can ram, will not take long to decide. But it becomes apparent how urgently dirigibles need the support of friendly aeroplanes to harass such attackers with close range fire, cleverly putting themselves into their way without masking the dirigible's fire, and even themselves ramming, if all else should fail. To cope with the swift turns of a "looper" takes indeed another "looper," and Germany might well afford to remember that she too has her "loopers" of the first order, though they did not compete in Vienna. The value of light, quickly turning machines her military authorities were beginning to realize during the past half year. Yet even the heavy standard military machines could offer protection to a dirigible against ramming "loopers."

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## Electricity

**Electrifying the St. Paul Railroad.**—The terminal of the St. Paul Railroad at St. Paul is now being electrified, and it is expected that the work will be done by the first of next January. Work is proceeding on the main lines, and it is believed that part of it will be operated electrically by the first of the year.

**Spanish Electrical Exposition.**—It has recently been decided to postpone the International Exposition of Electric Industries that was to have been held in Barcelona in 1915 until 1917, when the general Spanish exposition is to be held. The combined exposition will have government recognition, and $1,800,000 will be contributed by the Spanish government toward the cost of building and other expenses. A like sum has already been contributed by the city of Barcelona.

**Platinum Discovered in Germany.**—Electrical engineers will be interested to learn that extensive deposits of platinum have been discovered at Wendon in Westphalia, and that they are soon to be worked on a large scale. Hitherto, we have had to depend almost entirely upon the mines in the Ural Mountains for this metal which is so indispensable in electrical apparatus. Fully 95 per cent of the world's production of platinum has come from Russia.

**Electric Cooker for Chicago Baseball Team.**—As it is quite a journey to the downtown restaurants, an electric range has been installed at the ball park of the Chicago American League Baseball Club. It is equipped with three top-heating units and an oven with two additional units. One of the latter may be used as a broiler. On this range hot lunches are prepared for the athletes when they are too busy to go downtown for a meal.

**Miniature Motor.**—Mr. I. T. Nedland, a jeweler of Hillsboro, N. D., says the *Electrical World* recently exhibited at the University of North Dakota, Grand Forks, a working electric motor weighing 34 grains, the construction of which occupied his spare time for a month. The dimensions of the motor are as follows: Length, 0.563 inch; height, 0,291 inch; width, 0.336 inch; diameter of armature, 0.071 inch; diameter of commutator, 0.0106 inch. The armature, which weighs 4 grains, has six slots and six commutator segments. A 2.5-volt battery supplies the energy for operating this tiny power unit.

**Electric Fan for Horses.**—Believing that horses like human beings can do a better day's work after a good night's rest, the Utah Light and Railway Company has taken steps to rid its stables of flies and to provide better ventilation. Accordingly in one stable where thirty-five or forty horses are kept, two 56-inch 4-blade ceiling fans have been installed and two 15-inch blowers. These are set in operation on warm nights in order to make the stable more comfortable. They also serve to keep the flies from pestering the horses, and, in order to keep the flies out of the stable, the windows and doors are screened. The horses are used by the company to supplement its electric truck and motorcycle service. The running expense of the electric service is less than 40 cents per month per horse and is repaid many times over in the greater efficiency of the animals.

**Fire Damp Indicator.**—A new fire damp indicator was recently demonstrated in London. The device is adapted to indicate the presence of fire damp in coal mines. It is based on the well-known principle of catalytic combustion resulting from placing platinum black in certain explosive gases. The device is in the shape of a torch with two differential thermo-electric couples connected in series with a sensitive galvanometer. Each thermo-couple is embedded in a bead of porous material, one of which beads is impregnated with platinum black so that in the presence of fire damp it will become heated above the other, and generate a thermo-electric current, which will deflect the galvanometer. In order to make the platinum black as sensitive as possible, each bead is heated by a resistance coil to the required temperature. As both of the beads are heated alike, there is no deflection of the galvanometer under normal conditions.

**A New Powerful Search-lamp** is under test at the New York Navy Yard, in which high efficiency is obtained by using a greatly concentrated arc light. Heretofore it has been found that after a certain intensity has been reached, further increase of current results chiefly in spreading the incandescence over a larger area of the electrode. In the new search-lamp, the area of the light source is even smaller than heretofore, because the electrodes are much smaller, and they are kept from rapid combustion by a cooling stream of alcohol vapor. The new electrodes are but 16 millimeters in diameter, as compared with 38 millimeters for a current of 150 amperes in previous lamps. The alcohol vapor confines the illumination to the tip of the positive electrode which hollows out into a crater filled with incandescent fumes backed with white-hot carbon. The small spot of intense brilliancy approaches more closely to the theoretical point of light which is necessary to secure a perfectly parallel beam. The strength of the beam of the new lamp is about six times as great as that of the old. The alcohol vapor is generated by an electric resister. To obtain a uniform bathing of the electrodes in the vapor, they are rotated.

## Science

**Rio Theodoro.**—This name has been given by the Brazilian government, at the suggestion of Dr. Müller, Brazilian Secretary of State for Foreign Affairs, to the river recently explored by the Roosevelt-Rondon expedition, and heretofore known as the Rio da Duvida. Col. Rondon's report on the expedition gives the geographical co-ordinates of a number of points along the river, making it possible to place the river in approximately its correct position on the map. These are quoted in the July number of *Petermanns Mitteilungen*, and show the course of the river to be almost due north and south.

**The South American Expedition** of the University of Pennsylvania Museum has completed a year of highly successful exploration in the region lying along the boundary between Brazil and the Guianas. Besides important geographical discoveries, the expedition has obtained ethnological information relative to twelve different tribes, half of which were hitherto entirely unknown, including vocabularies and other linguistic studies, anthropometric measurements, collections of myths and legends, and about 600 photographs. The next work of the expedition will probably be in the territory drained by the upper Rio Negro and the upper Orinoco.

**The British Association in Australia.**—About 400 members of the British Association left England early in July, and were due to reach Perth, Western Australia, August 7th, from which point they were to proceed to Adelaide. Here the retiring president, Sir Oliver Lodge, was to deliver a valedictory address. After four days in Adelaide the party was to proceed to Melbourne and Sydney, at which places the greater part of the addresses, papers and discussions would be heard. President Bateson's presidential address was to be divided into two parts, delivered at Melbourne and Sydney, respectively. Many excursions will follow the meeting. One party will travel across north Queensland, while others will visit New Guinea, where the commonwealth government has placed a yacht at the disposal of a specific anthropological investigation.

**Spectacles for Artificial Light.**—Mr. H. E. Ives, an English physicist, who has been for some time investigating the production of light giving a daylight spectrum, has recently suggested the use of colored glass spectacles for viewing objects illuminated by artificial light when it is desired to see such objects exactly as they would appear in daylight. The glass would be covered with a collodion or gelatine surface, stained with aniline dyes carefully selected to filter out the light rays peculiar to artificial light. For each kind of the latter a special formula would have to be followed in preparing the spectacles. These spectacles would be useful in many industries, as, for example, the making of artificial teeth, where color has to be most accurately matched. They might also be lent to visitors at picture galleries, by night or on dark days, when artificial illumination is employed, in order to insure the most favorable view of the pictures. Many other uses will no doubt suggest themselves.

**Densities of Minerals and Rocks at High Temperatures.**—A new method for determining the densities of minerals and rocks at high temperatures is described by A. L. Day, R. B. Sosman and J. C. Hostetter in the *American Journal of Science*. The substance is held down by weights under an inverted crucible of graphite, which is immersed in a bath of molten tin or silver. Tin has the conveniently low melting point of 232 degrees. The measurements are made by noting the weight required to pull down the crucible and the assay to a given depth marked on a stem connected with the crucible. The graphite is protected from oxidation by an atmosphere of nitrogen and carbon monoxide. The density curve of the metal used and the expansion coefficient of graphite are, of course, factors in the calculation of the results. One of the most interesting of these is that as the temperature (575 degrees) at which $\alpha$-quartz passes into $\beta$-quartz is approached, a striking increase occurs in the rate of expansion.

**Exploration and Exploitation of Angola.**—This large Portuguese possession, one of the least known portions of Africa, has recently been the theater of explorations on a very extensive scale by a French expedition under Count Jacques de Rohan-Chabot. During the years 1912–1914 a total distance of about 4,350 miles was covered by the explorers, in the southern part of the colony, between the Atlantic and the Zambesi. Numerous positions were determined astronomically; magnetic and meteorological observations were made; and an ethnographic survey was carried out. The country was found to be very sparsely inhabited; in fact, there are vast territories without any inhabitants. The climate is unhealthful, and mosquitoes are a terrible pest. Nevertheless, the exploitation of this region is now greatly interesting German capital. Several missions of investigation have been sent thither from the adjoining German colony of Southwest Africa, and plans are on foot for developing a railway system, to be connected with the German lines to the southward.

## Aeronautics

**A Lighting and Starting Improvement.**—Patent No. 1,103,195, to William R. Gordon, of Kinloch, Mo., presents an air-craft of aerohydroplane type having a convenient arrangement of boat body and planes with a special view to equilibrium and alighting and starting in uneven fields.

**Shooting a Parachute into Operative Position.**—In a patent, No. 1,103,233, for safety appliance for air-craft, Edward L. Waight, of San Francisco, Cal., combines with a parachute case on an airship, explosive means for discharging the parachute from the case into operative position and automatically producing the explosion at the required instant.

**Another Gyroscopic Balancing Device for Aeroplanes.**—William R. Jones, of Summitville, Ind., has secured a patent, No. 1,102,515, in which is provided a gyro-pendulum which may be attached to aeroplanes, and is adapted for connection with the steering device to steer the aeroplane independently of the operator; also provides means for automatically balancing and steering the aeroplane either horizontally, up or down, or spirally, according to the preliminary action of the operator.

**Fins on French Machines.**—The question of spiral stability is receiving some attention from French designers. Our Paris aeronautic correspondent, Mr. John Jay Ide, tells us that the new army Morane-Saulniers are all fitted with a vertical fin forward of the rudder. No doubt a fin was found desirable on the Moranes on account of the fairly great amount of side area forward. R. Esnault-Pelterie was one of the first designers who realized that tail fins were desirable. His 1909 machines were fitted with them.

**The World's Aeronautic Laboratories.**—There are already six great aerodynamical laboratories scattered throughout the world. The oldest of these is that directed by Dr. Riabonchinsky, at Koutchino, in Russia; next comes that of M. Eiffel, in Paris, a private institution where this famous engineer has carried out research work of inestimable value for years past. Paris possesses another laboratory, planned on an ambitious scale, founded at St. Cyr through the generosity of M. Deutsch and controlled by the University of Paris. At Rome there exists a well-equipped laboratory belonging to the Italian Aviation Corps, and finally there is the admirable aeronautical section of the National Physical Laboratory at Teddington.

**A Combined Bomb and Arrow.**—M. Guerre, the inventor of an explosive projectile for destroying aircraft in the shape of a combined bomb and arrow, made some interesting trials of it from the Solferino Bridge in Paris. The projectile consists of a small and very light bomb with a very sensitive detonator which can be set just before throwing. In the rear of the shell or head is a guiding piece with "feathers," resembling a short arrow. Several of the projectiles were thrown from the bridge down on a bed of sand on the quay, and they took fire at once, exploding at the same time. Such a bomb would no doubt do great damage to an airship, and it is well adapted for use in an attack of aeroplanes upon airships, for instance.

**Shortening the World Flight.**—Commander J. Foster Stackhouse, of the British Antarctic oceanographical expedition, has pointed out a possible saving of 400 miles in the Greenland-Iceland leg of the round-the-world flight to Arnold Kruckman, the Panama aeronautical commissioner. The original route called for a 600-mile flight over the open sea from Greenland to Iceland, but Commander Stackhouse advises that the flight be made across Iceland instead of around the coast, because of the prevalence of fogs off the coast. He also pointed out that the extinct ice-capped volcano of Iceland was visible for 160 miles and would serve as a guide to the aviators when only a short time out of sight of Greenland, and owing to the numerous fishing vessels in those waters, the aviators would not be out of sight for more than half an hour at a stretch.

**New Aeroplane Wing Sections.**—Among the principal tests carried out in the National Physical Laboratory are the determination of the lift and drag of various wing sections, the distribution of pressure on planes, the resistance of variously shaped bodies—such as airship hulls or aeroplane struts—and the various aspects of stability. These experiments have led to the evolution of a highly efficient wing section, which has been incorporated in the latest military aeroplanes. The ratio of its lift to drift is close upon 14½ to 1; the under surface is almost flat, only the upper surface being curved or cambered, thus showing that, contrary to the general belief a few years ago, the upper surface of a wing plays an important part in producing lift. The deepest part of the curve is situated rather farther behind the entering edge than usual, being at a distance of approximately three eighths of the chord from the leading edge. By this means it has been found possible to avoid the sudden drop in the lift which, for some reason which still awaits explanation, occurs in the case of other types of wings when these attain an angle of about 16 degrees, and thus constitutes a serious source of danger.

# The Opening of the Cape Cod Canal

## Saving Seventy Miles Around Cape Cod

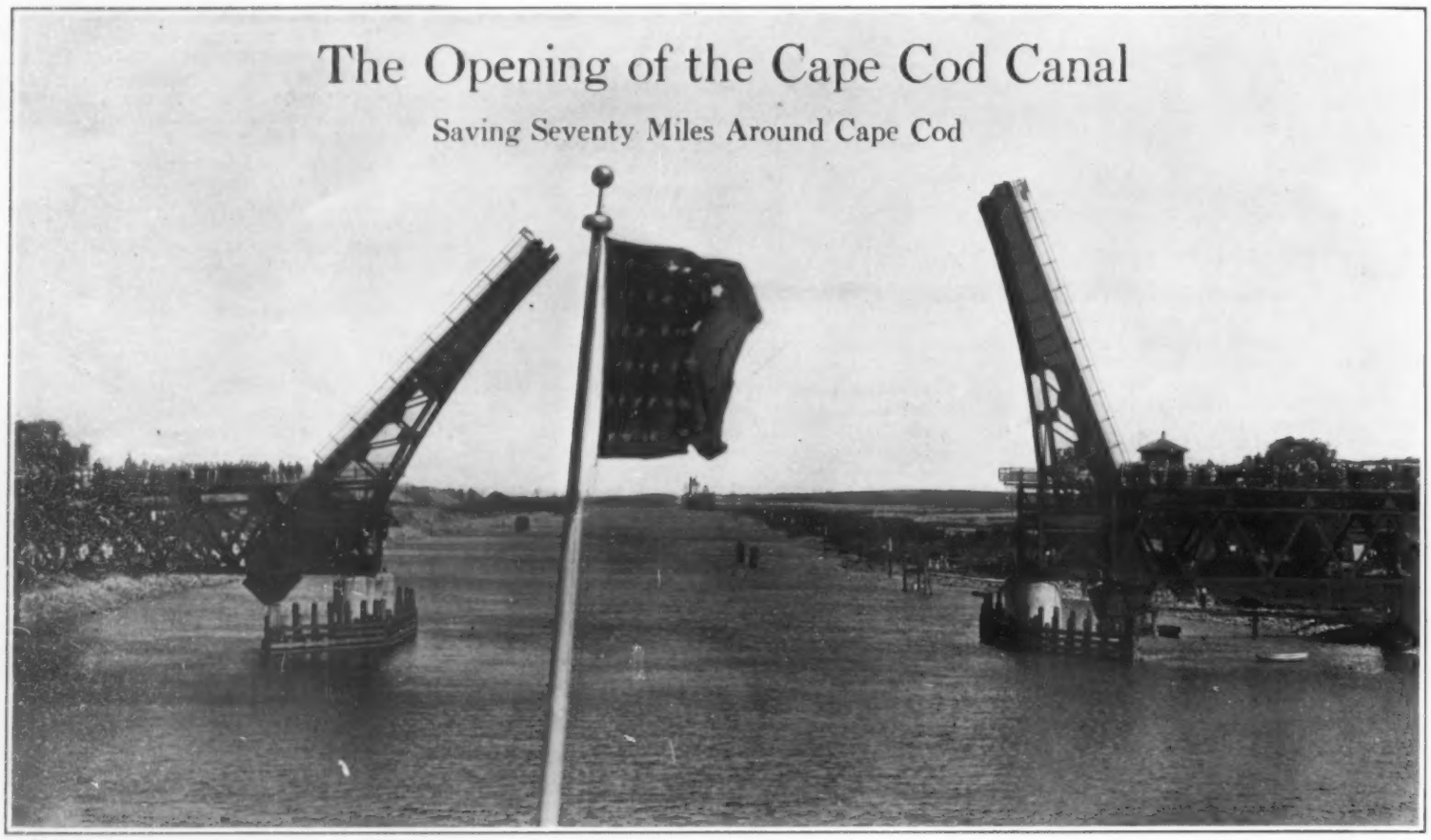
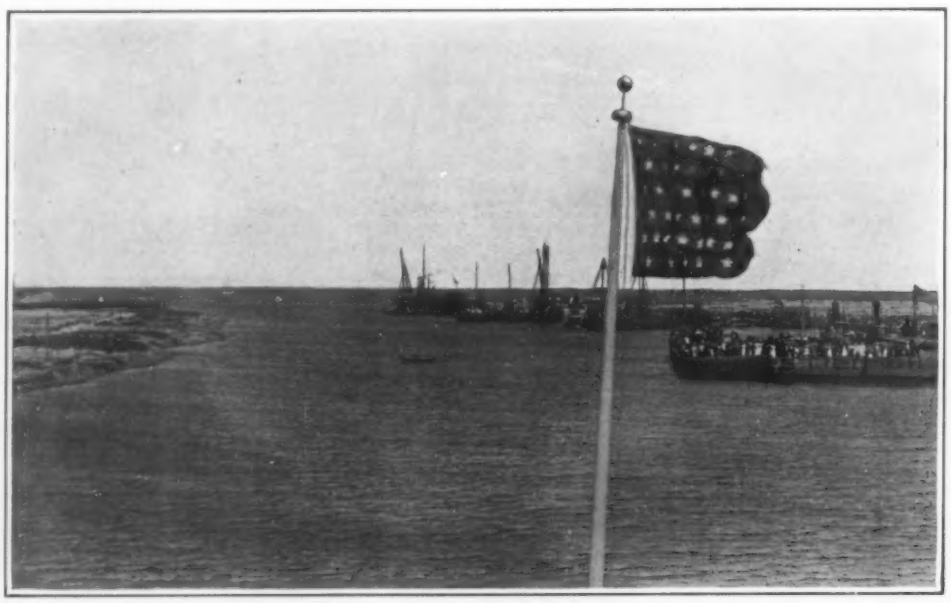


Photo. by Lewick.

**The Sagamore bridge near Cape Cod Bay.**

WITH the opening of the Cape Cod Canal, which took place on July 29th, one of the most important waterways in this country has become available for coastal navigation, but because of comparatively moderate size, and the absence of any spectacular engineering feats in its construction, so little attention has been given to the project in published descriptions that few people have any definite information in regard to the new canal, and a brief review of the principal facts relating to it seems appropriate at this time.

The canal proper is eight miles long, and is excavated across the narrow neck at the base of Cape Cod, on the Massachusetts coast, and connects the waters of Buzzards Bay on the south with those of Cape Cod Bay on the north, thus shortening the distance between Vineyard Sound and Boston by about seventy miles, and enabling vessels to avoid a considerable stretch of exposed and stormy water that is made especially difficult for navigation by numerous reefs and banks, together with strong currents, and also by the prevalence of fogs; and as a large portion of the traffic in these waters is by sailing vessels and towing barges, these factors have caused serious and regular delays, not to speak of many losses of vessels by shipwreck. Besides joining up the waters mentioned the canal has a wider significance as being an important addition to the series of protected waterways which are being perfected along a great portion of the Atlantic coast, and which will greatly promote and facilitate extended coastwise navigation by small vessels.



**Eastern entrance to Cape Cod Canal.**

There are no locks in the canal, as it has been built at sea level, although there is an actual difference of a few feet in water level between the two ends, but this difference creates no difficulties, and the slight current is regarded as an advantage, for it is not sufficiently great to affect vessels passing through. It is expected that it will greatly assist in preventing the formation of ice during the winter months.

There are no kinks or corners in the channel, and although there is a trifling curve, the radius of this is 7,640 feet, which makes the curvature so slight as to be almost unnoticeable; and as the entire canal is to be brightly lighted by electricity at night, there will not be the slightest difficulty in making the passage at any time either night or day. The only obstructions that will be met are a few railway and highway bridges, but as these are all modern, rapid-acting structures, having a width of 150 feet in the clear between piers, they should cause no practical delay.

Through most of its length the canal is about 100 feet wide on the bottom, and the depth is 25 feet at mean low water, but at three points in the passage the bottom width is increased to 250 feet to form passing points for vessels, and in the approaches to the canal a width at the bottom of from 250 to 300 feet is maintained. These approaches extend the 25-foot channel to deep water at both ends of the canal, and have a combined length of about five miles; and on the Cape Cod Bay side a massive breakwater has been carried out 3,000 feet from the shore line to protect the entrance of the canal from the filling-in action of the waves and to form a shelter harbor for shipping using the canal.

In excavating the canal most of the work was done by hydraulic dredges, as most of the material to be removed was of a sandy character. In this work two immense suckers capable of handling 4,000 cubic yards per day were employed. In one place a considerable deposit of bowlders was encountered, many of which were of large size, and it may be said that the removal of these, which was accomplished by large steam shovels, constituted the most difficult part of the undertaking. The total amount of material excavated is said to have been in the neighborhood of 20,000,000 cubic yards. At present the canal is open for vessels not exceeding 15 feet draught, but it is expected that a depth of 25 feet will be secured in the near future, and the plans look for an ultimate depth of 34 feet.

Although the Cape Cod passage was designed and constructed wholly as a commercial enterprise, already the European conflict has called attention to its special value in time of war. While for some time Massachusetts Bay and the New England coast have been considered weak points that would be difficult to provide for in any system of naval defense, the new canal has materially improved the situation. It will not accommodate our big warships, but it will soon be able to float vessels large enough and powerful enough to make a blockade of Eastern waters impossible for foreign ships.

The foregoing emphasizes the fact that this canal is wholly the result of individual enterprise. While large sums of public money have been annually squandered on "pork barrel" principles on obscure inland ditches whose use was entirely problematic, it has never been possible to interest the Government in an enterprise that possessed the unusual merits of public value evident in this new waterway.

Inconspicuous as this undertaking has been, it is undoubtedly one of the most important waterways completed in this country for many years, as the immense water traffic with New England, amounting to 25,000,000 tons per annum, has hitherto been obliged to make the long and dangerous detour around Cape Cod, resulting in long and constant delays and heavy losses to navigation which have constituted a severe tax on both

*(Concluded on page 122.)*

PROPERTY OF THE MICHIGAN UN... MAY BE REMOVED FROM THIS...

An attack from the rear.

# The Air Bomb

## A New Method of Mining the Air and of Thwarting an Attack by Flying Machine or Dirigible

## The Inventor's Explanation and a Critic's Objection

By Joseph A. Steinmetz and Carl Dienstbach

A contest of speed.

### Aerial Offense and Defense

**By Joseph A. Steinmetz**

AERIAL warfare, like fighting on land or sea, resolves itself into offense and defense.

The defense of land areas, for example the very vulnerable works of the Panama Canal, against attack and destruction by aircraft, can be successfully accomplished, as explained so fully by Mr. Dienstbach, by the use of aerial mines. This same scheme of defense would apply as well to the battleship fleet afloat, the units being so spaced that the balloons could not interfere or entangle when blown about in turbulent air.

The offensive action, or attack to destroy, involves problems new and more difficult, and here Mr. Dienstbach very ably sums up some of the possible troubles in a theoretical action. The attack, for example, against a Zeppelin would be delivered by several swift aeroplanes directly as the arrow speeds to the mark. It is not contemplated to maneuver an aeroplane with the pendent bomb hanging free. At the moment before passing over the object to be destroyed, the bomb is reeled out by gravity, and the speeding machine is across and beyond before the feed reel is checked. Using the enemy as the resistance body over which the wire is pulled permits of a run out of a thousand feet or more before the fatal charge is exploded into the gas bag. Such an attack at night or in uncertain weather, foggy or windy, would be irresistible, and the opposing artillery would be at a serious disadvantage.

In a black night the destroying aeroplane would fish for the noise of the enemy in the void below, and no matter what the swing of its deadly tail, could soon hook and destroy the leviathan of the air.

The aeroplane artillery units thus far devised have not been mounted to repel attack from the rear, but rather in view of forward action.

In no sense does the Steinmetz aerial offensive device usurp the place of the artillery, but supplements it. This fact would be developed in an engagement between two aeroplanes mounting guns, such as the bow mounts of the Voisin, Benet-Mercier, Farman, Deperdussin, and other French aircraft. The attack would involve a swift approach, and as was suggested in a recent newspaper review accredited to Lieut. Bellinger operating our O. W. L. planes with our fleet at Vera Cruz, "one aeroplane could ram and destroy the other." This is too expensive and wasteful a process of elimination. The recent dreadful tragedy in Austria, when an aeroplane slit open and ignited a dirigible, was an example of ramming. Therefore, with artillery equipped aeroplanes in action and coming together at a mile-a-minute speed, the result must be either a successful disabling shot, a head-on crash, a quick bank, or a vault over.

The plane equipped with the Steinmetz bomb unit would rise over the enemy, disconcerting his range, and, letting slip at the instant of incidence the death-dealing tail, would finish the affair.

The weight of artillery units with ammunition runs into hundreds of pounds, whereas the trailing bomb and wire reel equipment complete weighs but 25 pounds, and can be used with light weight aeroplanes by inexperienced civilian operators.

In time of war the units could be issued from stock in unlimited quantities and attached in an instant, without the delay and heavy expense of creating and mounting untried guns, more or less of experimental models. Indeed, it will always be a serious matter to find and train sufficient aerial artillerists, and this shortage will be always in proportion to the growing need of gunners for the land and sea batteries.

There is another phase of the pendent bomb destructive units not touched upon by Mr. Dienstbach; the attack at ground level in destroying the hangars and dirigibles at rest, igniting the gasoline and commissariat supplies, derailing troop trains, and crippling transports.

On water the attack could demoralize landing parties, smash the wireless of battleships, blow off the periscopes of submarines, and perform similar service, impossible at night by aeroplane artillery.

A quick mobilization for war of the air forces would include civilian aviators flying private craft and unfamiliar with artillery science.

In Germany owners of large motor trucks are subsidized as army transport units to serve in time of war. In some such manner must privately owned aircraft be counted as part of the aerial defense of nations.

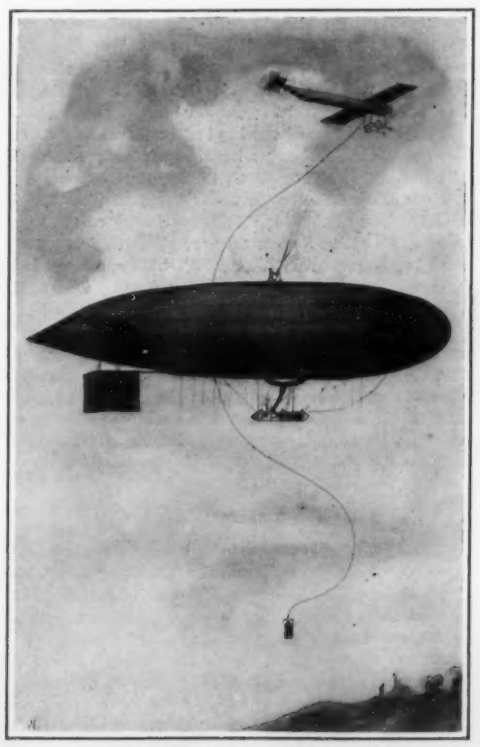
Such an air force must be available at almost instant notice and must be lightly equipped and mobile, able to defend itself as well as to destroy.

The civilian aviators and raw recruits will not be skilled artillerists, but must, wasp-like, be able to strike and sting with pendent bomb delivering out of the blackness of the night down to the enemy their *coup-de-grâce*.

### A Criticism of the Steinmetz System of Aerial Offense and Defense

**By Carl Dienstbach**

SO close are the analogies between warfare at sea and in the air, it was no more than natural to propose the adaptation of mine and torpedo, which play such a highly important part in naval war, to aerial conditions. The thought has been amplified and perfected in an interesting device recently patented by an American, Mr. Joseph A. Steinmetz. This device has the advantage of great simplicity and cheapness. As its inventor was well aware that the largest aerial dreadnought may be destroyed by the smallest amount of explosive, he hit on the idea of merely combining three well-known elements. He suspends a hand-grenade from a small "pilot" balloon held to the ground by a long piano wire. When the wind is high he proposes the substitution of a device entirely identical with the meteorological box kite in daily use at aerological observatories for lifting meteorographs to great heights. The hand-grenade, somewhat differently suspended, takes the place of the meteorograph. Inasmuch as the Lindenberg observatory in Germany publishes daily every change in the location of its kite wires and employs beacons at night as a warning to aeronauts, the use of the Steinmetz device is obvious, all the more as it may be readily manufactured and distributed in immense quantities, and, once established, be operated by an army of unskilled feeble non-combatants. The small balloons may be sheltered on the ground in any stable or shed and be sent up or hauled in at will by any sort of reel or windlass. The one rather complex accessory required would be a gas-carrying automobile, such as is used for the replenishing of the diminished gas supply of German dirigibles in inaccessible places; for daily rounds of the whole mine field must be made to refresh the balloons by a few cubic feet of pure gas from steel bottles.



Attacking with pendent bomb.

The experience of meteorologists, however, tends to show that the handling of kites is by no means simple or easy, and that the wholesale use of the device which constitutes its chief value will, therefore, be likely restricted to calm weather. This suggests at once another indispensable accessory—a signaling system to the multitude of unskilled operators for instantly passing the command to "haul in." Such an important decision may obviously not be left to their individual discretion.

A curious and entirely novel use seems to suggest itself here for wireless telegraphy. Optical signals are not dependable; acoustic ones too audible; and signaling by wire is too expensive. But wireless is excellent for distributing intelligence. Its very essence is distribution, and it seems high time that this peculiarity, which for regular commercial telegraphing represents rather a necessary evil, should for the first time be turned to advantage in war. As the distances to be bridged from a central station are comparatively small, the reliability is irreproachable, and the simplest apparatus suffices. The receiver reduces itself to a "magic pillbox" before the eyes of the unskilled operator, with a little dial on which one single change indicates the instant for hauling in. Wireless, now so commonplace in its usual employment, becomes again such a marvel in this novel rôle, that one wonders why its hidden possibilities are not more thoroughly exploited.

The value of the Steinmetz device is not diminished as much as it may seem by restricting its use to calm air, for the simple reason that the enemy's dreadnought dirigibles will obviously operate at night, and will pick out the calmest of the generally calm nights for finding their objects of attack and casting their bombs with something like accuracy. The moral effect of expecting to run into a mine at any nook and corner will more

than repay the outlay; especially, if it will restrain aircraft from operating in weather in which they are most to be feared.

As the value of the Steinmetz device lies entirely in quantity, a warning against its use in turbulent air seems justified. Observation officers in the baskets of military captive balloons in any wind are often hauled down seasick after having been blown about. It would not take a storm long to transform an aerial mine field into a hopeless tangle of live bombs which would presently come down on the heads of those that were to be protected.

The aerial mine is inferior to the sea-mine not only in its vulnerability to currents, but also in its visibility. Furthermore, it cannot (at first sight) be more dangerous to aircraft than a sea-mine would be to submarines, which, unlike ships, are likewise not restricted to one level of flotation. Against all these handicaps the air-mine can oppose only its cheapness and lightness. The former quality allows its use in countless quantities, the latter covers not only one but many levels of flotation, as an aircraft striking a wire will most probably strike the mine as well, just because the wire will instantly cut into the soft outer material of the structure, and unless it tears, provide for itself a guide from which it cannot slip until it has hauled the mine at its end against the moving craft.

Visibility is a more serious drawback, as the first balloon sighted would be undoubtedly the signal for a Zeppelin to rise to its top level of flight, but that in itself would be protection to those below. But as efficient aiming requires comparatively moderate altitudes, the Zeppelin might not wish to rise higher than necessary above the level of that first balloon. It is at once seen how important it is to anchor these balloons at a variety of levels, all, of course, as high as practicable, by allotting the lengths of wire according to the skill or clumsiness of the operators. Discovering the balloons at night would be at best like guiding a steamer at night among icebergs. Compared to the pace of a modern Zeppelin, the "Titanic's" fatal speed was insignificant. It is seen at once how useful air-mines will be in reducing the speed of attacking aircraft, in making it possible to spot them with searchlights and shoot at them.

Mr. Steinmetz also proposes to turn his mine into a torpedo, or means of offense, by omitting the small balloon and suspending the bomb by a long wire from a dirigible or an aeroplane. He thus intends to "hook" other aircraft with an explosive grappling device, by dragging the wire from above across the bulk of a dirigible or an aeroplane. The plan has the merit of simplicity; without previous alteration any aeroplane or dirigible may thus be equipped for attacking.

But its efficiency is far more problematical than the mining scheme. Unless the attacking craft follows a rigidly straight course for miles without change of speed, the bomb at the end of the long wire is bound to oscillate through an immense arc. Even so, the wind should rock the light bomb easily. If the attack requires lively maneuvering—as it naturally should with the enemy trying to dodge—the course of the bomb will be very erratic; and the wire's direction become so irregularly different from that of the attacking craft that the enemy's being hit will be as much a matter of accident as with a stationary mine. If it were possible to set a whole mine field moving; in other words, fly a whole flock of aeroplanes in close order, each dragging its bomb—the plan would evidently be even more efficient than stationary mines. But it would, obviously, quickly result in a general disastrous entanglement. A few widely scattered bomb-dragging aircraft would, on the other hand, be worse than a few widely scattered mines. They would be more conspicuous and, moreover, at any possible range of their erratic weapons the point-blank high-angle fire of the enemy would be of deadly accuracy. Generally speaking, as meritorious as the modified mining idea may prove in the air under certain circumstances, as misplaced seems the idea of aerial torpedo attack. For this there is no object, because, unlike at sea, in the air a shell hit is just as deadly as a torpedo hit.

## Suspending Life

### By the Paris Correspondent of the Scientific American

IT appears from Dr. Becquerel's remarkable researches that life can actually be suspended for periods of time which can last almost indefinitely; then the organism, which appeared quite dead before, is seen to come back to life and resume its usual functions. The importance of the following experiments made upon the lower orders of life can hardly be overestimated, for the results are of such a nature as to establish to all appearance that life is not a continuous phenomenon, but can be actually stopped, then to recommence again. The following was written for the leading Paris newspaper, *Le Matin*, by Dr. Becquerel, who has a prominent position in the botanical department of the University.

It may be asked whether it is possible to suspend the vital functions of a living being and thus free him from the action of time for an undetermined period, then bring the subject back to life again. Such is the far-reaching problem which biologists have before them in connection with the phenomenon of "latent life," that singular faculty possessed by microbes, spores, eggs of certain crustaceous animals, seeds of plants, and even completely developed animals such as rotifers and other lower orders. In all cases they appear to undergo a natural mummification from the fact of drying up, and can wait several years or even much longer, then coming back to life under favorable conditions for their evolution. However, in nature it is quite difficult to ascertain whether such germs have their life only slowed up or really stopped, for their drying is not complete and their protoplasmic substances always contain a certain amount of water or gases which serve to keep up their physiological functions, even though in a very feeble state. But in the laboratory the result is not the same, for we now possess more powerful means, and by using almost perfect vacua, very strong agents for removing the water, and sources of heat, it becomes possible to keep the germs alive and at the same time remove all water and gas from their cells. Prof. Maquenne demonstrated this in the case of wheat grains, castor bean and others, and the author did the same with pea and buckwheat. It was thought that perfect suspension of life had been thus realized, but others maintained that such was impossible, and were it so, that death must ensue. The vital functions were not actually stopped, but only very much slowed up, for there may be a very slight difference between an almost and an entire suspension of life which is enough for the purpose. Dr. Becquerel then undertook to answer this objection by the use of the extreme cold afforded by liquid air and hydrogen. The striking experiments made by Pictet, Dyer, Fadyen, and Dewar showed that germs could resist such intense cold, but the germs still contained water and gas and were not placed in a vacuum. To make the result conclusive, the three conditions for suspension of life must be united, that is, greatest amount of dryness, highest vacuum, and greatest cold. The author was fortunately able to realize all this at Leyden by the aid of the eminent scientist Kammerlingh Onnes, who placed the resources of his laboratory at his disposal. Thus the specimens could be kept for three weeks at the temperature of liquid air (—190 deg. Cent.) and then for seventy-seven hours at the extreme cold produced by liquid hydrogen (—250 deg. Cent.), using grains of wheat, mustard, spores of aspergillus and others, and various bacteria, all of which were kept in sealed glass tubes having the greatest possible degree of vacuum. The three conditions of cold, dryness, and vacuum were now realized to a remarkable degree. It is gratifying to state that the experiment was a complete success. All the grains at the end of one year and the spores after two years in vacuum, once planted or otherwise allowed to grow, were seen to germinate quite as usual. It is to be noticed that in this very special case the cells were deprived of water and gas, and the protoplasm became hard as stone and lost its state of colloidal solution, at least while it was under the combined action of cold, dryness, and vacuum. It can no longer be objected that the life is only much slowed up, for it is well known that life without water, gas, and chemical reactions is impossible. Dr. Becquerel thus maintains that the experimental suspension of life, all the while with the possibility of coming back, and this for a time which appears to have no limit, is perfectly realizable.

Such a result brings about physiological consequences which are most interesting. In the first place, it refutes the great principle of the continuity of vital phenomena, by which it was affirmed that life is a succession of uninterrupted phenomena which could not have the least stopping without causing death. The axiom "life comes from life" now receives a setback, for in the present case life is actually stopped, then it commences again. Before the present phenomena it will be impossible to maintain the "vitalist" doctrines which certain scientists and philosophers still uphold. Life is not, as they think, a mysterious force or a directive power which comes from a world in which physics and chemistry have no part and which for that reason escapes the inflexible determinism of natural phenomena. Continuing the ideas of Claude Bernard, the author takes the ground that life is no more than the exceedingly complex physico-chemical working of protoplasmic organisms, which are determined by their incessant relations, their continual exchanges with elements of matter and different forms of energy.

Not less disconcerting and of wonderful scope, are the biological consequences of the suspension of life. By using such methods in the laboratory, it will be, perhaps, possible to preserve specimens for as many centuries as need be, using, for instance, germs of certain vegetable species and to hand them down to our successors as check specimens or points of comparison in order to determine the amount of evolution of such species, comparing the new with the old. Then another remarkable conclusion enters in, that when the sun's energy fails—and that will happen sooner or later in some hundred thousand centuries—when all the living beings perish, their germs may be preserved in a latent state of life for a very long period after that. In fact, the three conditions of vacuum, dryness, and cold would then be realized. It is a question what would become of all the germs which are preserved on our planet when it takes the conditions of the moon, for instance. Were the earth to come under the influence of a new sun, it may be asked whether the new radiations would awaken the germs to life, and thus commence a new animal and vegetable reign. Or if not, the planet might break into fragments from shock or explosion and the meteoric fragments charged with the germs, as Lord Kelvin thought, would go to re-people new worlds. Probably not, the author thinks, for chemical and microscopic examination of meteorites does not bear out that idea.

## Plants and Disease

SO closely is the idea of suffering associated in our minds with that of disease, that it appears at first sight a mere figure of speech to refer to certain disorders in plant life as "diseases." A very little reflection, however, shows that the term is fully justified, and that pain, while a very frequent concomitant of disease in animals, is not its chief characteristic. In fact, such pain may be regarded as a danger signal, warning the organism to take *action* against an enemy. And just because the higher plants do not *actively* oppose enemies (since they have, in the majority of cases, no mobile organs) there has been no occasion for a sense of pain to be developed in plants.

How, then, do plants react against injury? How do they resist such attacks?

It may shed some light upon this question if we briefly consider the corresponding inquiry: How do animals react against injury? In this case we find that there are two distinct methods employed. An illustration will best explain this point.

If the enemy is sufficiently large to be discernible by the senses, the organism reacts either by seeking protection in flight or under cover, or by warding off the enemy by direct counter attack. But with invisible foes—microbes—this method fails; the organism then has recourse to physiological and chemical weapons of defense. The phagocyte or amoeboid cells of the blood do their best to devour the invading hosts of microbes. At the same time antitoxins may be manufactured in the body to counteract the toxins or poisons produced by the bacteria. Now a plant is to all intents and purposes blind, deaf, and devoid of all our finer senses. It must, therefore, react against many enemies plainly visible to us, just as we react toward the invisible microscopic hosts. The fly alighting on cattle in the pasture is promptly whisked off by a member specially provided for this purpose. But an insect alighting on a plant is free to make such attack as its nature prompts, for the plant in all but a few exceptional cases of insectivorous species, neither sees nor feels the enemy, nor, even if it did so, would it be able to ward it off by action.

It is, therefore, only reasonable to expect that plants may in a large measure use chemical means to ward off not only microscopic, but also larger enemies. We should naturally expect that plants, devoid as they are of active means of defense, should have developed to a rather higher degree than is the case in animals, various passive means of defense. Among such there readily occur to our minds thorns and prickles, which indeed are extremely common protective devices in plants. But is it not very probable that plant juices also may serve to keep off insects and other enemies? If so, we should expect that any degree of malnutrition, any deficiency in soil, any excess of moisture or other untoward circumstances, should immediately expose the plant to the danger of invasion by insects and other pests. And *vice versa*, we should argue that the most rational method of fighting such invasion would be, not so much to attempt the often extremely difficult task of exterminating the preying species, but rather to strengthen the plant so as to enable it to manufacture those juices by means of which it wards off enemies.

Plausible as these conjectures appear, it must be admitted that facts are not wholly in harmony with them. For while in some cases plants are very strikingly more susceptible to insects when the plants are weakened, authorities tell us that in most cases the insects seem to find vigorous plants just as susceptible as the weak ones. With fungous and bacterial diseases the greater susceptibility of weak plants is more general, although not universal. The cases in which plants are suffering from malnutrition, abnormal soil conditions, excessive moisture, or other unfavorable circumstances, are very large, however, and such plants are found more susceptible to these diseases.

# Correspondence

*[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]*

## Science and Baseball Pitching

To the Editor of the SCIENTIFIC AMERICAN:

A thing greatly to be desired is a testing place for baseball curves. I suppose the best place would be on the premises of one of the league grounds; handy for leading pitchers in turn from all parts of the country, as well as for local men; but conducted by residents, e. g., a few men in turn appointed by the scientific or athletic department, or both, of some nearby college or association. The apparatus would be cheap—a few small screens for right and left curves. Up and down deviations, if gone into, would require something more. Here could be carried on for a considerable length of time (as desirable) an accumulating, confirming series of tests; e. g., as to how often, relatively, balls curve out of the plane of the parabola; if it is caused only by twirling the ball; if it can be done at will; or how frequently; by what pitchers or class of pitchers; which revolutions, right or left, produce which curves, etc. The accumulated and reliable data would be of great practical use to pitchers (as we shall notice further) and to science. Better find out just what really happens, and how much, before trying to explain how or why it happens.

There seems to be an almost universal belief in the wide use of in and out, up and down "shoots," "fade-aways," "floating corkscrews," etc. The scientific mind naturally asks (1) why this large belief in this large performance; (2) what cause there may be for some curvature. These are not necessarily the same question. There was some advantage in the old-fashioned college curriculum, including, e. g., something of both psychology and physics. In all the published discussions that I have seen it seems to be taken for a settled fact that all this throwing of wide curves is going on all over the country, and that it is up to the material scientists alone to explain it all. Psychology suggests, e. g., how much of what most people believe is from hearsay. How many out of tens of thousands get squarely in front of pitched balls and try to see if there are lateral curves? In a case like this the opinion of the great majority is utterly worthless. Next, of those who have carefully tried to see, how many know the absolute requirements; that you must get the catcher out of the way and have your eye exactly in the plane of the parabola to see whether the ball goes out of that plane. And how is any human being going to know just where that invisible plane is going to be? So much for those who simply say, "I have seen it." As an approximate test of appearance, I stretched a fine wire about sixty feet long. On it I hung a baseball by a sliding ring. To the ring I attached a small fish line, and arranged weight and pulleys so that when released the line would draw the ball swiftly to the other end of the wire. If I placed my eye at the wire, of course the ball would seem to come straight all the way. But if I was a little away from the wire, the ball would seem to come straight toward me at first (so sharp the angle of deviation) and then to swerve off quickly toward the last. This, I repeat, was only a test in appearance. The curve of the falling ball would complicate it more. Optical illusion is more common than many imagine. Everybody used to believe the sun rose and set, because they "saw it." They killed Bruno for denying it. Some insult people now for doubting what they "saw." Animal painters always thought that horses ran in a certain way till the kinetoscope proved them entirely mistaken. In moving pictures (founded on optical illusion) there is a special illustration of curves, viz.: If there is represented something coming from a distance toward the spectator, say a railway train, it will seem to come straight toward you, or almost so, and just as it passes, to curve or swerve off to the side in a most astonishing way. But we know there could be no such curve in the railway track. Suppose your eye is half a foot off the parabola. The ball in coming ten feet deviates only about an inch from your plane, so sharp is the angle, and in half a second it whisks by you half a foot to the right or left. Of course, it seems to curve, especially at the end of the flight. So much as to the "they say" and the "I saw" and the psychology. What influences more educated and even skeptical minds is that writers in leading magazines refer to those curves as settled by experiment. From these and from articles that I could obtain on the subject, about all that I could learn was that a long time ago the experiment was tried with "two posts," that about forty years ago it was done at Yale; thirty years ago a prominent pitcher, on the eleventh attempt, pitched a ball that went on the west side of a 2-inch stake, on the east side of a 5-inch fruit tree, and on the west side of an inch rake shaft; and one, I think, with better apparatus, somewhere in Ohio. These experiments should not be denied or underrated. They aimed to see that a certain thing could be done. But they are not scientific proof of all the curve pitching that the masses talk about. I would say, by the way, that less than three posts can prove nothing, and posts, trees, and sticks leave some room for doubt. I used three screens. I may add that I did not succeed in pitching any curves. However, I had to move away soon. I left the screens on the grounds, but never heard of anyone succeeding, although there were some wonderful "curve pitchers" about. With all the talk and print about curve pitching all over the country by amateurs as well as professionals (the wonderful shoots, jumps, etc.), one would think what a skillful science and practice it must be by the great league pitchers. (Of course those men are not responsible for what is said about them.) But what do we find? Mr. Irwin said the great professional pitchers he consulted did not pretend to know the theory of curves. One thought of trying to see if he could pitch curves purposely as he wished. This is the great age of science, and baseball is an obsession of this country, and still all this curving is asserted and denied.

As to explanations, so far: We know that a sudden gust of wind coming at the efeventh or other time will deviate a ball some. But that is not frequent enough to confuse a series of tests, or could be guarded against.

Mr. Irwin and the professors seemed to see the inadequacy of the twirling theory, and they threshed out in vain the falling of various bodies through mediums of various densities (reported in *Collier's Weekly*). I would suggest the fact that all bodies falling through a medium near their own density are liable to deviate, as a feather or ping-pong ball in the air, or a billiard ball or marble in water when it gets down where the water is nearer the density of the ball. But the air is nothing like so dense as a baseball. And we know that the thrown baseball does not slow up like those falling balls. The theory of air compression was discarded.

Can we suppose that if projected balls were given to unaccountable deviations gun practice would be so reliable and accurate as it is?

The revolving of a ball on its course causes deviation. But how much? A rifle ball is revolved on a plane perpendicular to the course to keep it straight. We will only note here that it requires a tremendous explosive force to do it. A cricket ball is not pitched as fast as a baseball, and a little twirl when it strikes the ground will deviate the rebound some. A tennis ball is smaller, has a frictional surface (purposely), and the racket has a broad and very rough face, so that by a slanting, grinding blow the ball can be made to revolve with great rapidity, and the grind on the ground will give a greater deviation still. A golf ball is small, trenched or corrugated, and when hammered with a hard club, so much heavier than itself, with a slanting stroke, it will spin and curve considerably in its long flights. The wind also has quite a chance at it, too. The billiard ball receives a shot-like, longitudinal impact from the cue and twirls on the frictional cloth, and being heavy, retains its motion the longer. A baseball hammered by a bat on one side, that is, a heavily batted foul, will spin considerably. Now, a baseball has no ground or cloth table-cover to spin against. And to compare its revolutions in the air with those other balls we will have to imagine a baseball fired from a rifled cannon, or hammered by a golf club several times its weight, wielded by a giant, and allowed to soar a long distance; or by a giant tennis racket, etc. It would require a human hand of steel, swivel wrist, and explosive revolution; a kind of "double million magnifying glass" gyroscope, as Sam Weller might say. But anyone can get some idea of what a hand can do in revolving a baseball. Color part of a ball, so as to see better, and let watchers stand near the line along which the twirler pitches the ball. Anyhow, if it spins rapidly it will not always stop on striking the ground, and some of its spinning will be seen. Then there is the handicap of making it revolve to the right or left, up or down, and all in addition to the strain of control and speed, without which the best pitcher will be batted all over the grounds. A practical question is, is it wise for a pitcher to additionally strain and distract himself by that which is not yet systematically tried out and reported? And, by fuller facts, theories of explanation ought to be helped. One of these is that friction of the air on the side of the ball revolving forward is greater than on the side revolving backward, and acts as a brake to swerve the ball to the forward revolving side. I knew the head of a high school who held this theory, but taught the pitchers to twist the nose of the ball in the direction he wanted it to curve. The Bernouilli theory is that the side of the greatest velocity is the side of the least pressure from without. Is not the side of the greatest velocity the side of the ball that is revolving forward in the direction of the ball's flight? And is not the side revolving backward the side where the air goes by the ball less rapidly, the side of the greatest pressure from without? According to the theory, the ball would be pushed to the side revolving forward, the side of less pressure. But Prof. Franklin seems to me to draw the opposite conclusion.

Suppose a pitched ball is revolving nose to the left. Pressure and purchase being greater in front than behind, it would seem that the ball would claw or work itself to the right. Also, the right being the side of greatest velocity, least pressure, the ball would tend to the right, by the Bernouilli theory. These forces might be true and yet overbalanced by a third and greater force, which we may call the wedge. The surface of the revolving ball on the left front quarter is by friction sweeping the air out of the way and backward, while on the right front quarter it is sweeping the surface air inward and forward against the oncoming air, so that the greater resistance pressure on that quarter wedges the ball over to the left. As a ship moves forward, if there is a little more floating ice on one bow it will tend to wedge the bow over to the other side.

I repeat for emphasis (1) most of what we believe is from hearsay; (2) that those who only say "I have seen it" should consider that, for one to see and know the curves in question, he would have to know just where the plane of the parabola is and have his eye there; (3) optical illusion is more common than the unscientific imagine and seems to have been ignored in this discussion; (4) a testing place, carried on for a reasonable time, would be a benefit to players and science.

S. C. THOMPSON.

Ocoee, Fla.

## The Current Supplement

A NEW device for measuring stellar radiation, described in the current issue of the SUPPLEMENT, No. 2015, appears to make possible more extended investigations in an interesting field.—The Westinghouse turbine reducing gear is described, and the ingenious construction that has made it practical is fully illustrated.—Sir Ray Lankester tells how to get struck by lightning, and how not to, including much useful information about lightning.—In the riddle of Mars the theory of the canals is discussed from a new point of view.—Some important harbor improvements in the island of St. Thomas are described and fully illustrated.—The first contest for safety of aeroplanes, at Paris, tells the story of what the Sperry gyro stabilizer did, and an illustration of the apparatus is given.—Recording moonlight and night cloudiness calls attention to an entirely neglected branch of atmospheric observations and records. Other articles discuss the protection of battleships against submarines; the geological action of man in changing the topography of the earth, and a survey of the manufacture of alcohol from wood refuse.

## What It Costs to Kill a Man in War

WHEN the Lane Medical Library of Stanford University was dedicated on November 3rd, 1912, Dr. David Starr Jordan delivered an address, in which he stated: "In modern war, it now costs on the average about $15,000 to kill a man. In the late Boer war, this expense ran up to nearly $40,000. It is cheaper to save men. It is cheaper to stop killing. In our own country, in the time of peace, when nothing but peace is possible among civilized nations we spend nearly a million dollars a day on matters concerned with past or future wars; $850,000 a day, on future wars alone, that we may not be caught napping when the day of the impossible shall arrive."

## Blériot and His Supposed Transatlantic Machine

THERE recently appeared in the daily press a statement, credited to Mr. Arnold Kruckman, that Louis Blériot is building a four-motor transatlantic machine. Immediately upon the publication of this announcement, we requested our Paris aeronautic correspondent, Mr. John J. Ide, to investigate the matter. He forwards us a communication from Blériot, in which it is stated: "I have not the slightest intention of constructing a machine for crossing the Atlantic, and still less for a journey around the world. I know nothing at all of the apparatus to which you refer."

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**Surveying with an Automobile Truck.**—In extensive surveys to be made this summer by the Coast and Geodetic Survey and the Geological Survey, between Barstow, Tex., and the Pacific Ocean, an automobile truck will be used for transportation, in place of horses and wagons. A special machine is used for the purpose, equipped with solid rubber tires, dual behind, and extra tanks for gasoline and water. The same plan was tried with great success in two previous seasons; last year, in surveying between Denver and the Canadian border, it was estimated that the expense of this mode of transportation was about half of what it would have been if horses and wagons had been used.

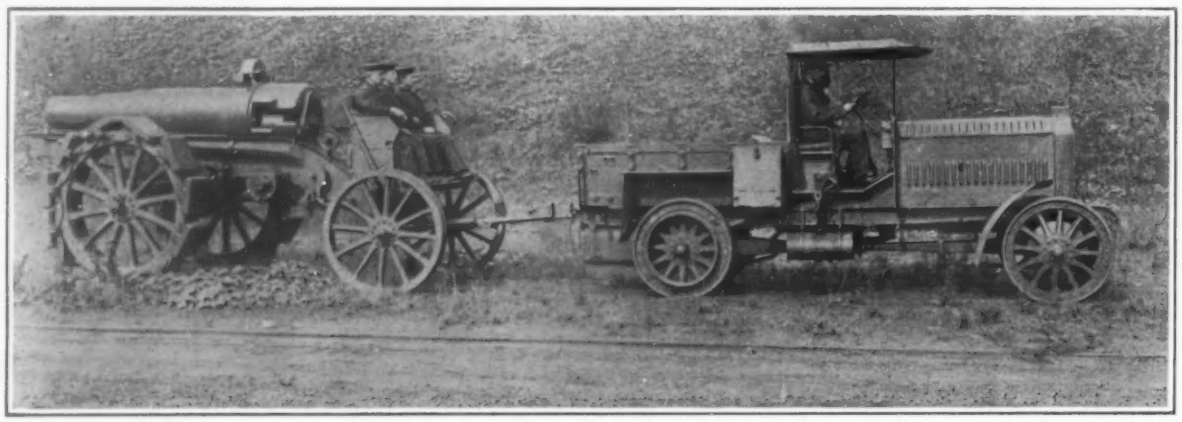
## German Artillery in the War

ARTILLERY has always played an important part in the military operations of the German army. According to the latest figures available which may be taken as of 1912, Germany had 3,866 field guns against 2,936 for France, 1,854 for Austria. Russia seems to have been a pretty good customer of the German gun shops, for she has no less than 4,432 field guns. England, with 1,170 field guns, is outclassed by Italy with 1,470 guns. German artillery is in the front rank, and the great Krupp establishment is one of the industrial wonders of the world. Now we have the supreme test when Krupp rifle and mortar are pitted against the products of the best English and French ordnance factories.

German artillery has already shown great efficiency, and it is probable that the fate of the present war on land will be largely dependent on field and siege guns. Siege operations are usually long drawn out on account of the time required in changing the solid firing platform as the lines around the invested city or fort are drawn closer.

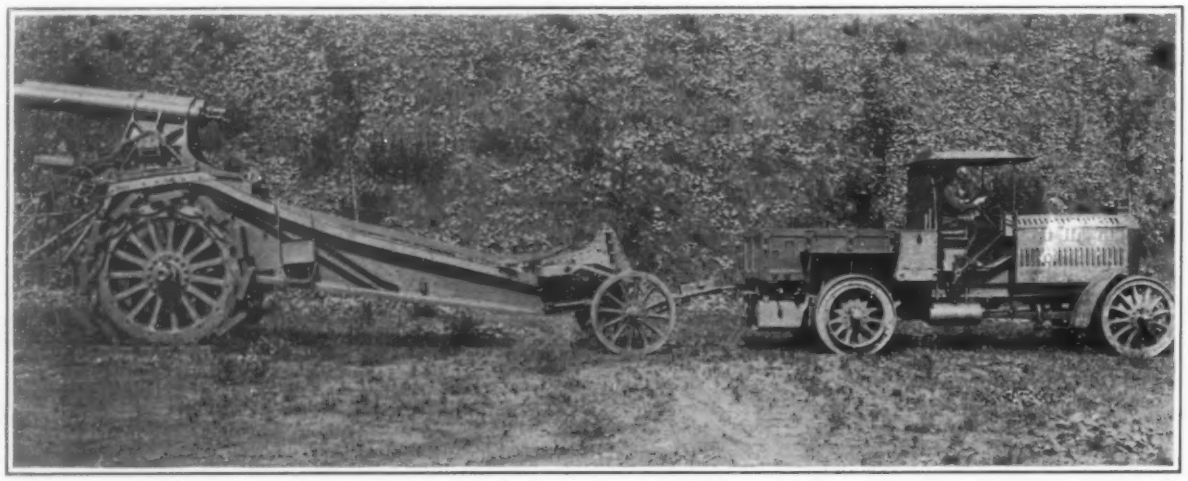
Realizing this deficiency in mobility, the Krupp firm has designed a new type of mortar of this character, the salient feature of which is that it is mounted upon a gun carriage, so that it can be moved from point to point, and can even be attached to the artillery in field operations. This end is achieved without any sacrifice of ballistic efficiency, by the application of a long invariable recoil, and by the employment of wheels fitted with feet after the manner of the Diplock pedrail.

The Krupp designation of this piece as a howitzer is to distinguish it from the mortar proper, reserving the latter title for those weapons able to fire at an angle exceeding 45 degrees. This new arm has a greater variation in its elevation, so that it really is more flexible in use. The two terms, however, are now so generally confounded that it may be classed as a mortar.



**The 11-inch howitzer is hauled by cars.**

Bore, 11 inches; length, 11 feet; shell, 136 pounds; powder, 38 pounds; maximum elevation, 65 degrees; maximum range at 65 degrees, 24,278 feet; maximum range at 42½ degrees, 33,135 feet.



**Transporting part of the mounting of a powerful mortar by motor car. Gun and mounting are assembled where fired.**

The barrel is made of steel, and comprises the inner bore and a jacket, the total length being 11 feet. The carriage upon which the arm is mounted comprises in reality two vehicles. The barrel or mortar proper is carried upon one carriage, while the other carries the mounting with the recoil brake and the two air reservoirs. In transport the two pieces are hauled separately, the main wheels of each carriage being shod with feet, so as to permit passage over soft ground without sinking, while haulage is carried out by gasoline motor cars, as being more suited to the work than horses. Upon arriving at the position of firing, the mounting carriage is planted first, and then the second carriage is moved up from the rear, until the bore is in line with the cradle of the mounting. By means of thin wire cables and pulleys the mortar is pulled from its own carriage, and slides over special guides through the opening in the second carriage, until it is in the designed position, where it is made fast and connected up. The second carriage is then withdrawn, leaving the arm complete upon the mounting carriage and ready for firing.

The training gear gives a maximum elevation to the mortar of 65 degrees and works upon a rapid system. The weapon can also be moved 5 degrees on either side in the horizontal plane. The upper part of the cradle into which the bore slides carries a group of three cylinders. The central cylinder is the recoil brake,

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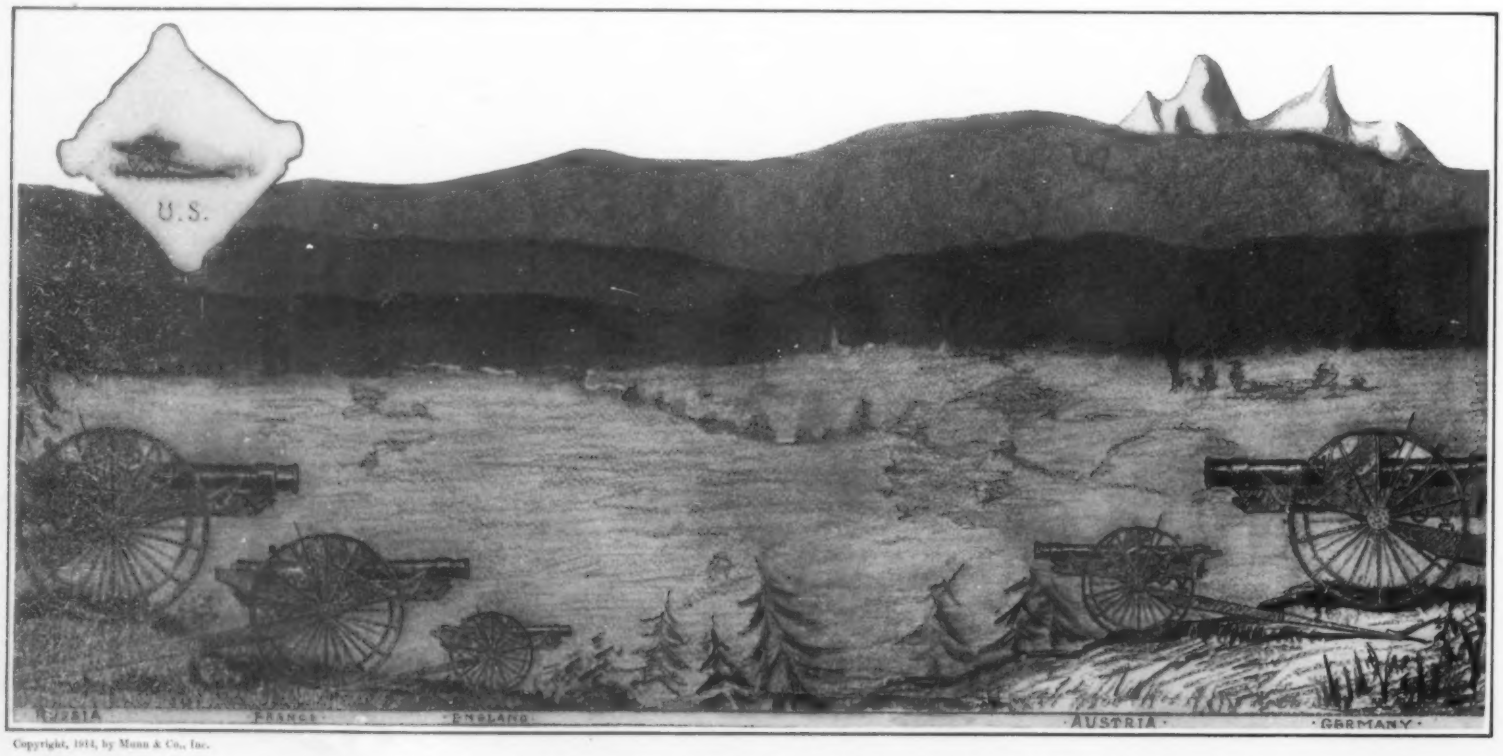


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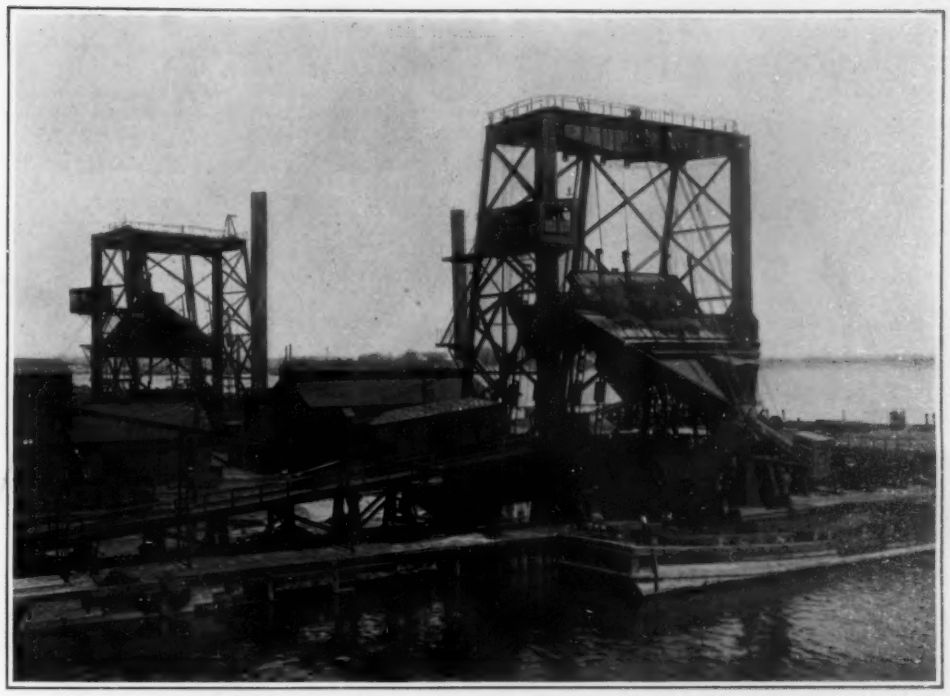
**A graphical comparison of the artillery of the principal powers at war and the United States.**

## The Unloading of Coal From and To Vessels

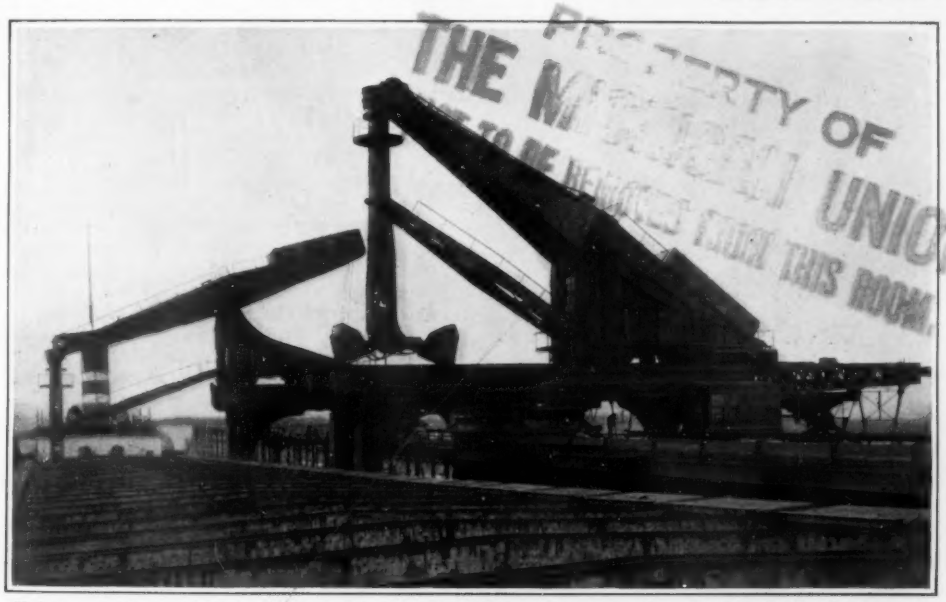
By J. F. Springer

WHAT is perhaps the most up-to-date method of unloading coal from a vessel is used in an installation at Fort Williams, Ont. For a number of years, the Hulett unloader has been in use in the United States in connection with the unloading of iron ore, especially from whaleback vessels. This same device constitutes the principal feature of the plant at Fort Williams.

Briefly, such an unloader consists of an immense beam pivoted near the center in such a way as to permit a movement in a vertical plane. At one end—the working end—a vertical leg is pivoted, at the bottom of which is the device for seizing a quantity of the material which is to be handled. At the other, or non-working end, is located the cab of the general operator. This man controls the vertical movements by which the vertical leg is let down through a hatchway into the hold and later on withdrawn, the load having been secured in the meantime. There is a loading operator who occupies a position in the lower part of the vertical leg and who manages the movements of the bucket which reaches out and gets the load. He is able to cause the bucket to swing round in an arc and to extend itself. So perfect is the whole operation that it has been found possible to secure mechanically up to 97 per cent of the load of iron ore. The entire apparatus, rocking beam and all, is supported on a carriage capable of movement on a second carriage underneath it. This "foundation" carriage may be moved back and forth on suitable tracks on the dock parallel to the length of the vessel. The carriage to which the rocking arm is pivoted has a longitudinal movement perpendicular to this. By counting all possible movements, the unloader may be made to operate everywhere in the hold—fore and aft, port and starboard, high and low. The great efficiency of these machines with iron ore has no doubt been the reason why they are now being adopted for use with coal.



Car dumper in action at a South Amboy pier, New York harbor.



Hulett unloaders at Fort Williams, Ontario. One of them has just released its load of coal; the other is down in the hold, grabbing eight tons of coal.

The Fort Williams plant is equipped with two unloaders, each capable of securing an 8-ton load of coal. There is in addition a rehandling and stocking bridge having a length of 475 feet. The unloading equipment is at the front of the dock. After an unloader has secured its load, the latter is discharged into a conveyor car belonging to the unloader. This car is discharged into either the scale lorries preparatory to a discharge into the bins or into a storage pit. There are thirty bins arranged in two parallel rows of fifteen each.

The cars to be loaded are run beneath the bins on two tracks at a lower level. Thirty cars may thus be loaded at one setting. It is not necessary that they be loaded simultaneously with the unloading of the vessel.

It is said that a vessel having a load of 12,000 tons may be unloaded by one of the unloaders in about twelve hours, the capacity of the unloaders being 450 or 500 tons per hour.

The reverse procedure, that of transferring coal to a vessel, might not seem at first blush to involve any especial difficulty. However, the amounts to be handled are so enormous and economy of time and operation are so important that the most highly perfected methods of to-day have been the result of a long period of development. The most up-to-date provisions are to be found no doubt upon our Atlantic Coast. Here we have four harbors—New York, Philadelphia, Baltimore, and Norfolk—which are already provided with fifty-six coaling plants, and in two of which four more plants are under construction. In New York harbor alone, there are thirteen separate ports and twenty-nine coaling plants. In the year 1911, a total of 1,000,000 carloads of coal were discharged by the coaling plants of these four harbors into vessels of various types. These four harbors have a daily coaling capacity of more than 11,000 carloads, although none ever operates at capacity for any considerable length of time.

The coal is handled in various ways. In many cases, it never encounters anything which would usually be termed a mechanical device. In others, the mechanical apparatus is a very prominent feature. In still others, there is a combination of mechanical devices and pier operation.

Indeed, one may choose to regard the arrangement of the levels and grades of a pier and of the storage bins and discharge chutes as a gigantic piece of apparatus, the whole being run by locomotives and gravitation. And who could deny that we have here the essentials of a machine? In one case, you will have the railway tracks on a pier arranged on a gentle up-grade as the outer or sea-end is approached. The loaded coal cars are simply pushed out onto the pier by a locomotive operating from the rear. When the cars have been discharged into the bins beneath the tracks, the down-grade toward the shore end becomes of service

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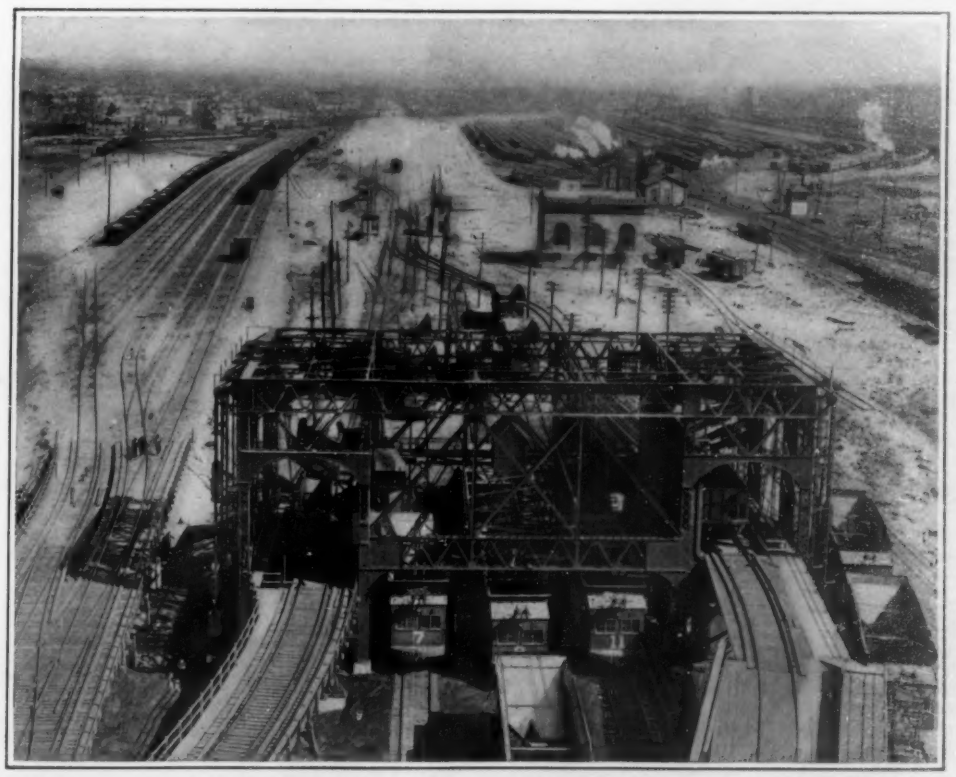
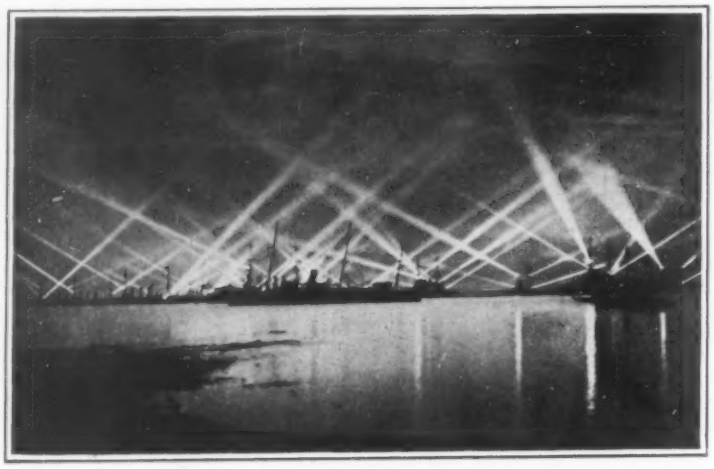


Head frames of coal car elevators at shore end of great pier of Norfolk and Western Railroad, Hampton Roads harbor, Va.

## Searchlights of the German Fleet

THERE is no use in having powerful and efficient arc lamps if the light is not reflected by mirrors of the proper section and polish; and in this respect a German inventor has succeeded in producing grinding machinery that will turn out perfect parabolic mirrors of any desired diameter, and of a wonderfully fine polish. The largest of these mirrors, 2 meters, or say 6.56 feet, in diameter, acting on a source of light of 440,000,000 candle-power, will illuminate large objects in favorable weather so that they may be distinguished at a distance of 18.5 kilometers, or 11.5 miles; and their light has been seen at a distance of 400 kilometers, equal to nearly 250 miles. The accompanying photograph shows a searchlight display of the German fleet in the harbor of Kiel.



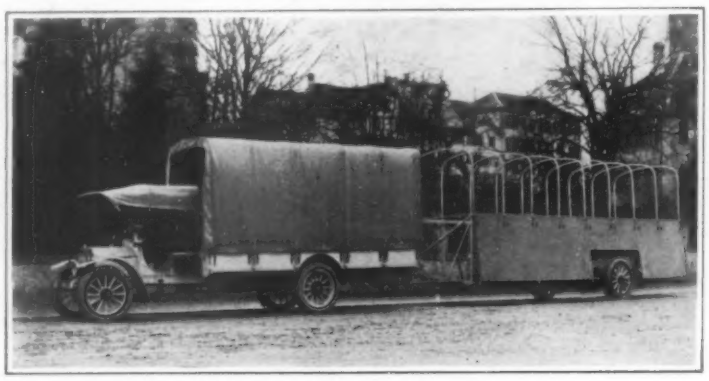
German fleet turning night into day.

## Hearing Type

A NEW form of optophone constructed to enable totally blind persons to read ordinary books and newspapers, by means of the ear, has been invented by Dr. E. E. Fournier d'Albe. A perforated disk rotates in front of a Nernst lamp, and produces a bright line consisting of dots giving flashes of different musical frequencies. An image of this line is thrown on the type, which reflects the light upon a selenium bridge. Each letter gives a characteristic sound, which is heard by means of a telephone attached to a Brown telephone relay.

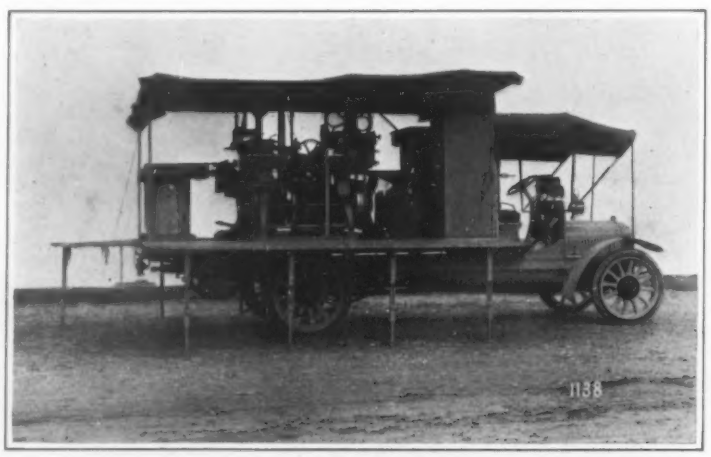
## Aeroplane Motor Cars for the Russian Army

A LARGE number of motor cars, designed to comply with special requirements, were recently supplied to the Russian army by a prominent Swiss firm. These comprise a complete aeroplane squadron, ambulance vehicles and a workshop car. The touring cars of the aeroplane squadron are mainly intended to serve as means of rapid conveyance for the officers, a special feature being that they carry two folding stretchers which, in cases of emergency, are readily lifted into the car from the rear. Each car is designed as a tractor for an aeroplane-carrying trailer, and accordingly is fitted at the rear end of the frame with a spring draw-bar and suspension device for a two-wheeled trailer. In one of our photographs we show an aeroplane motor unit in which the tractor is a motor truck designed for a load of two tons. The wooden arches of the body are designed to be lowered, thus reducing at will the total height of the vehicle, so that it will pass through tunnels when transferred to railway cars. The two-wheeled trailer, as shown in the photograph, is at the front end fitted with four resilient diagonal stays, joined in a pyramid at the point of suspension, so that an entirely safe and elastic connection between the tractor and aeroplane carrier is insured.



Russian aeroplane motor unit, consisting of a two-ton truck and aeroplane trailer.

The aeroplane carrier contains a number of interesting constructional features. Its dimensions far exceed the usual limits, the bridge body being about 25 feet long by 7 feet wide, and nearly 10 feet in clear height. The aeroplane to be transported can thus be introduced without dismounting anything (apart from the planes). The height of the vehicle can, however, be reduced as required by lowering the wooden arches. The platform rises only to a height of about 16 inches above the ground, thus allowing aeroplanes to be introduced in as simple and convenient a manner as possible. As the suspension device in front of the aeroplane can be removed, aeroplanes can be loaded at will from the front or rear.



A motor repair car of the Russian aeroplane corps.

Our other photograph shows a transportable repair shop. In view of the constant additions to the automobiles owned by army authorities, a want has been keenly felt for such transportable repair shops allowing any repair work on motor cars or aeroplanes to be done in the field. The very substantial body of the car, which is mounted on a 3½-ton chassis equipped with a 30 horse-power motor, has a sailcloth roofing. The upper halves of the side and rear walls likewise consist of sailcloth, while the lower halves are substantial planks, which can be folded down to form a platform on which the men can work. The equipment comprises a lathe, drill, band saw, milling machine, field smithy and anvil, carpenter's bench, etc.

The machinery is designed for hand as well as electric operation by means of a dynamo installed in the car. This dynamo is driven directly from the motor of the chassis through a silent-tooth chain-drive, and can be thrown in and out at will. The total weight of the vehicle, inclusive of its equipment, is about six thousand kilogrammes.

## Bureau of Standards Furnace for Testing Building Materials

By Hartley M. Phelps

WHAT is probably the most efficient furnace for the testing of the fire-resisting qualities of building materials ever constructed in this country is being completed by the United States Government at the Pittsburgh, Pa., station of the Bureau of Standards. It is also to be used for load-testing under immense heat. The conditions of the tests will be as near as possible those obtaining at a fire, and where streams of water are being played on the heated material. For the housing of the furnace a building of light structural iron framework on which are sheets of corrugated iron for the walls, has been erected; the building and furnace representing a cost of about $5,000.

The Government is a large consumer of all kinds of building materials; so it is of the utmost value to Uncle Sam to know just what these materials will stand in the way of wear and tear under all kinds of stress. In the new furnace such commodities as fireproofing and hollow-tile material; gypsum and cement blocks, concrete, metal laths, and other forms of structural substances will be exhaustively tested under various heats. Standards of heat endurance will be ascertained and formulated for all refractories. Such valuable information to contractors and those contemplating building is made available through the bulletins published by the Bureau from time to time.

The furnace is in the form of a parallelogram, and is built of fire-brick, two big piers of solid brick taking up the lower part of the interior. There is an ingenious system of flues, the heat being applied by burners in which natural gas, mixed with compressed air, is burned. One side of the inclosure is open, and here a panel 8 by 6 feet is built up of the material which is to be tested, the panel, held in an iron frame suspended from I-beam travelers, forming in fact the other wall of the furnace. By suspending it the panel may be moved away from the furnace and tested for the action of water, which is sent against it through a hose or several streams.

A feature of the work will be the testing of safes and filing cabinets to see whether papers contained in them are damaged by fire. Any manufacturer may send such objects and have them tested free if such testing is in line with the work being done by the Government.

For the testing of loads under high heat the material to be tested—a column of concrete, cement, etc.—is placed on the brick piers, and on top of the material hydraulic jacks of great power are set. These jacks exert both a downward and an upward pressure, the upper pressure being against a heavy steel beam.

The furnace is to be in charge of Walter A. Hull, expert in testing fire-resisting qualities of building materials. He entered the Government service recently, after wide experience in fire-brick plants in the South and elsewhere. P. H. Bates is head of the Bureau of Standards branch at Pittsburgh.

## Schaumann Armor Plate

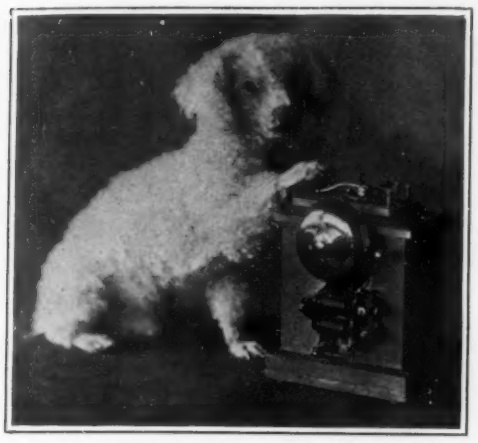
FOR several years the German naval administration has been experimenting with a new type of armor plate, invented by the Koenigsberg engineer, Schaumann, which appears to possess considerable merit. The special advantages claimed for it, in comparison with other armor plate, include diminished cost of production, reduction of weight by one half, and increased power of resistance to projectiles. The Schaumann plate is not homogeneous, but is composed of an outer plate of nickel steel and an inner plate of soft metal, connected with each other at intervals. When the outer plate is struck by a shot, it is not perforated because the inelastic backing prevents it from yielding beyond its elastic limit.

The *Kriegstechnische Zeitschrift* describes experiments in which Schaumann armor plates were repeatedly subjected to the impact of projectiles of the "S" type. These projectiles, fired from a distance of 500 meters, perforate a 3½-millimeter plate of nickel steel, but produce little effect on a Schaumann compound plate of the same weight, composed of 2 millimeters of nickel steel and 3 millimeters of soft metal.

A Schaumann plate composed of 2½ millimeters of nickel steel and 5 millimeters of soft metal is not perforated even when the range is shortened to 75 meters. Schaumann plates are particularly well adapted for army use, as they are light enough to be used in the construction of shields for machine guns, and even perhaps for rifles, as well as for field pieces. The shields now used for field pieces are 3 to 5 millimeters thick and weigh 50 to 60 kilogrammes, and a reduction of weight is desirable in the interest of portability. The Schaumann plates successfully resist infantry fire at very close range, and they will probably afford good protection against shrapnel. The experiments hitherto published were made with plates of small thickness. The superiority for thick armor plates remains to be proven.

## A Mathematical Dog

REPORTS have appeared at fairly frequent intervals in the daily press of the remarkable feats performed by various "talking" animals. The most famous of these



Hector, the canine mathematician.

are, no doubt, the Elberfeld horses. Quite recently the editors of the SCIENTIFIC AMERICAN were given an opportunity to make direct observations on Hector, Mr. C. J. Tryon's French poodle, of "mathematical" propensities. The dog performs a number of ordinary tasks, in addition to his exercises in "mental arithmetic." One notable feature is that he correctly obeys instructions spoken in an ordinary tone of voice, without special emphasis on key-words, and rather complicated in character. Thus, for example, he correctly followed out the programme when told to walk around a chair (on his hind legs), to stop when he got to the back of the chair, to bark at his master, and then to come all the way round and sit up on his haunches. He would upset one of the editorial waste paper baskets (very needful articles of furniture here) either by pulling it over with his paw, or by pushing it over with his nose, according to orders.

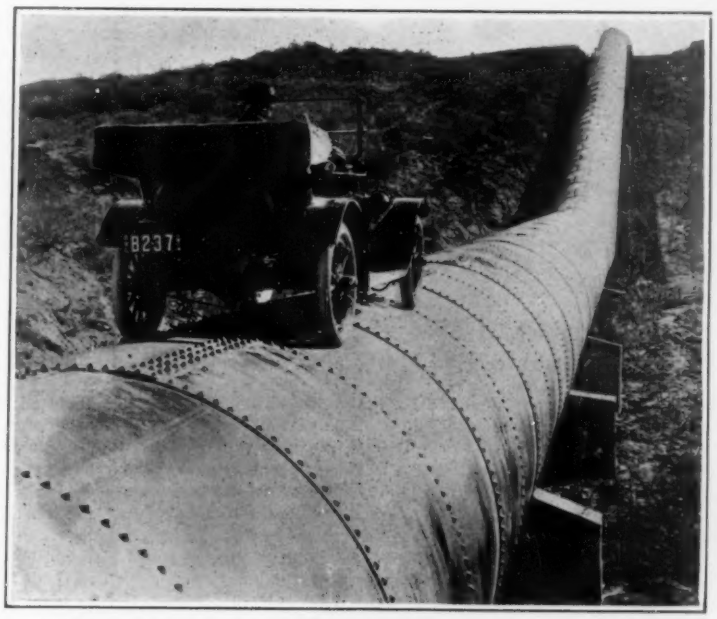
But these tricks might be duplicated by other performing dogs. The wonderful part of Hector's performances is his figuring of sums. He has before him an electric bell, behind which he sits at attention. A sum is given him to do, such as, for example, "what is 3 times 6?" The dog pauses, apparently in thought, with half-closed eyes, and presently, with his eyes intent on his master, he taps out 18 on the contact key of his bell. It is not necessary for his master to face the dog. In most cases he stood with his back to the dog, some fifteen or twenty feet away. It is not even necessary for the sum to be stated aloud. Apparently the dog gets his clue by a species of thought-transference. In several instances the sum to be figured was stated in a whisper to Mr. Tryon, and presently the correct answer came from the key. The dog taps out the answer so rapidly that it is sometimes quite difficult to follow in counting the strokes. Errors were occasionally, but very rarely, made, usually taking the form of one or two strokes in excess of the correct answer. He gave answers in addition, subtraction, and multiplication.

A written account, such as this, of the dog's performance is wonderful enough, but there are features in the phenomenon which have to be seen to be fully appreciated. The dog behaves very much like a person performing so-called thought-reading. Inasmuch as the true nature of this is still somewhat a matter of dispute, it is only natural that the dog's performances should seem somewhat obscure. This much can be said, that so-called thought-reading, at least in some forms, demands little or no thought on the part of the medium, so that there is no obvious reason why an animal should not be capable of functioning in this capacity as well as a human being.

It may perhaps seem unnecessary to furnish a demonstration that the dog does not actually work out the sums given him to do, though some rather thoughtful persons seem to consider such a thing possible. Such demonstration was, however, furnished at the *séance* given by Mr. Tryon at the office of the SCIENTIFIC AMERICAN. It was proposed to give him something difficult to do, so he was asked to find the square root of nine. He correctly rang out: Three. Now he had never heard the words square root before. The greatest mathematician that ever lived could not solve a problem stated to him in an unknown tongue. If the dog succeeded, this cannot be because of great mathematical powers, but because he finds the answer by a process entirely independent of mathematical reasoning on his part. It must be thought-transference of some kind—whether by almost imperceptible signs unconsciously given by his master or by some occult process not within the range of present-day psychology; that is a question which we will leave undiscussed. Hector is not a stage performer. He has been taught and trained by Mr. Tryon, who is a mining engineer from Arizona.

## Motoring on a Tube

A FEAT that called for not a little nerve was performed when an automobile enthusiast recently drove his car up the siphon of the Los Angeles aqueduct, across Bouquet Cañon. He made the trip of one mile in good time and without mishap, but it required a steady hand and a cool head to keep a perfect balance astride the big tube. A slight swerve, particularly where a heavily riveted joint broke the smooth surface, would have a tendency to send the machine skidding over the side. The trip would not have been so difficult of accomplishment were the course of the aqueduct level, but in many places a grade of 10 per cent had to be negotiated, and there it was no simple task to keep the machine on the excessively crowned roadway. From the size of the tube, as shown in the illustration, a fall from the top would be disastrous.




Driving a motor car over the Bouquet Cañon siphon of the Los Angeles aqueduct.

## New Stretcher for the French Navy

A NOVEL stretcher for transferring the wounded and injured has been introduced in the French navy and tried out successfully during the maneuvers

New stretcher used by the French navy.

in the Mediterranean. The apparatus consists of metal and is of such shape that the body rests in it comfortably and will not be disturbed while the stretcher is transferred from the ship to a launch and from there to the hospital ship, even though the stretcher be tipped until the wounded man occupies a sitting posture. It is strongly built, and will not break or give if it should be thrown against the ship's side while being swung out. A prop under the upper end of the stretcher keeps the head higher than the feet. Such a stretcher is a vast improvement over the ordinary canvas conveyor, which permits constant changes in the position of the body.

## The "Whip" at Luna Park

CONEY ISLAND is easily the most popular seaside resort in the world, and an attempt has been made within the last year to extirpate all objectionable elements, and we are glad to say that success has crowned the efforts of the reformers. The existence of huge amusement parks like Luna Park goes a long way toward raising the tone of a resort. In this unique inclosure some sixty shows and concessions serve to pass away the visitor's time in an agreeable manner.

The latest amusement device installed in the Park is called "The Whip," and is the invention of Mr. William F. Mangels, a well-known designer of carrousels and similar devices. In an inclosure is a track having alternate straight portions and turns, curves or corners, upon which track run cars propelled by an endless chain to which the cars are independently connected, so that each car will travel along the straight portions of the track and acquire a quick, centrifugal motion in passing around the curves, turns, or corners, the suddenness of which causes agitation or commotion of the occupants, and hence much merriment and amusement, and as the car passes the turn it again takes up a trailing position until another turn is encountered. The endless chain has a constant speed of travel, but the speed at the corners is variable, like the cracking of a whip. Means are provided so that the free play of the car is limited as it passes the corners. A sprocket wheel at one end serves to actuate the chain, an electric motor in turn driving the sprocket wheel. "The Whip" vies with the "Witching Waves," which we have already illustrated, with being the most popular amusement devices on the Island.

"The Whip" at Luna Park, Coney Island.

The cars are "snapped" at the corners by centrifugal force.

## Over the Alps With a Passenger

THE greatest flight across the Alps with a passenger was made on July 27th by the Italian aviator Landini, accompanied y Dr. Lampugnani. A monoplane was used, the start being made from Novara at 5 o'clock A. M., and, passing over Monte Rosa, which is 15,217 feet high, Viege was reached at 7:50, a distance of a hundred miles. The aviators suffered intensely from cold, and were twice lost in the clouds.

# Inventions New and Interesting

## Simple Patent Law; Patent Office News; Notes on Trademarks

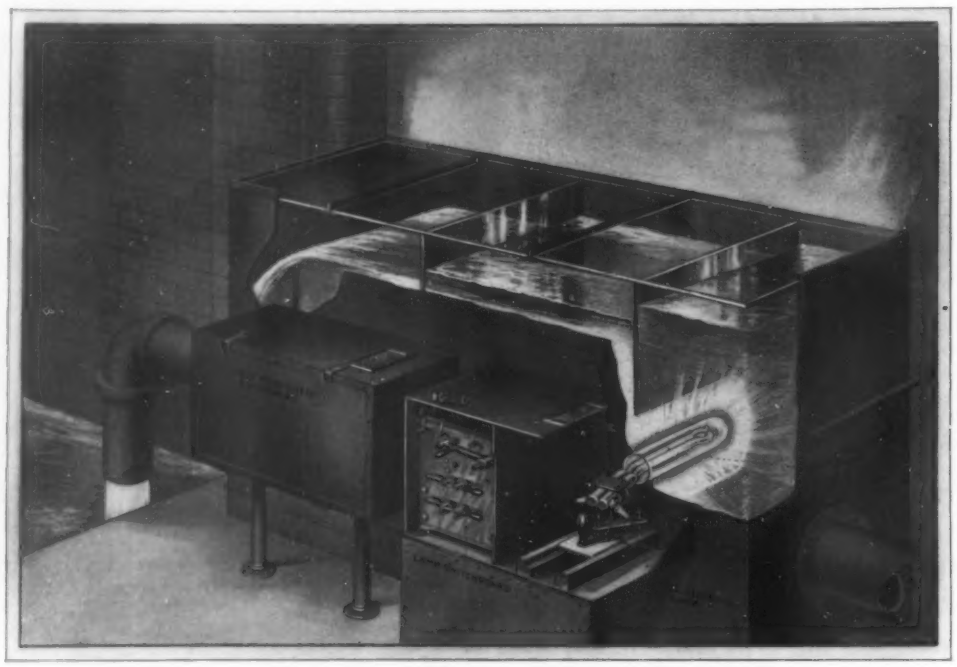
### Sterilizing the Water of Swimming Pools with Ultra-violet Rays

By Dr. Max von Recklinghausen

IT is a common practice to circulate the water used for swimming pools through a filter so as to remove the impurities which are imparted to it by bathers, and then to conduct the water, thus purified, back to the swimming tank. This simple filtration process, however, is hardly sufficient to purify the water to such an extent that it will surely be harmless. With present methods it is impossible to eliminate disease-producing bacteria—an end which can be obtained with a filter only if the water is circulated with sufficient rapidity through the purifying system.

That the water of our swimming pools, however carefully filtered, is anything but pure and free from bacteria is evidenced by some tests which have been made in one of the large modern Y. M. C. A. swimming pools in New York city. These tests showed that the bacteria count near the outlet of the purifying apparatus revealed many thousand bacteria per cubic centimeter, and among these bacteria were some of intestinal origin. This swimming pool has lately been provided with a modern sterilizer in which the ultra-violet ray is employed. The apparatus, as the accompanying illustration shows, consists of a flume into which two quartz tubes protrude. Two 220-volt, 2.2-ampere mercury-vapor lamps known as "pistol lamps," because of their characteristic shape, furnish the necessary ultra-violet radiation to the water. The water is continually taken from the bottom of the tank and made to pass very rapidly through a filter in order to remove any suspended matter which may have been brought in by the bathers. It then passes through the ultra-violet sterilizer. The water which leaves the tank, instead of containing many thousand germs per cubic centimeter, contains only about one twentieth of that number; moreover, all bacteria of intestinal origin are absolutely killed. In this way the same water can be used over and over again for weeks and months at a time without any danger of disease.

Thus the remarkable germicidal properties of ultra-violet rays are applied in a remarkably practical way.



How the water in a swimming tank is purified by ultra-violet rays.

### Baltimore's Car-ferry

By Harry C. Plummer

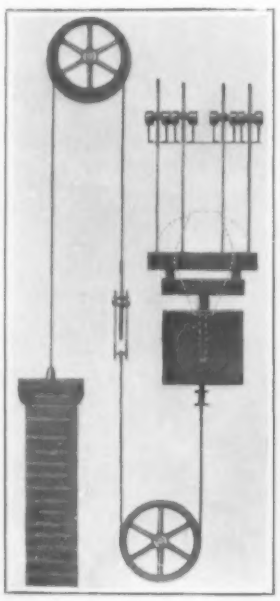
TO relieve traffic congestion on the electrically operated four-mile belt-line maintained by the Baltimore and Ohio Railroad, in the city of Baltimore, which is in constant use for both passenger and freight service, that company has restored the car-ferry which formerly was in operation between Locust Point and Canton, on opposite sides of Baltimore harbor, and which the belt-line was built to supersede. The twentieth century restoration of the nineteenth century car-ferry has entailed not only the purchase of new car-float equipment, but the building of a special type of steel transfer bridge, which has been both dictated and facilitated by the peculiar physical and traffic conditions existing in the harbor of the Maryland metropolis.

Several large car-floats have been put into operation in the new freight ferry-service, and the company recently placed a contract for two steel car-floats with a capacity of fourteen cars each. The latest transfer bridge was designed by the railroad's engineering department, under the supervision of F. L. Stuart, chief engineer, and W. S. Bouton, engineer of bridges. A noteworthy feature of the new bridge is the provision of a system of pick-up counterweights which, as the outer end of the bridge settles with the coming on to the span of the live-load, comes into action and takes up the load reaction of the bridge at the water-end. This, otherwise, would come upon the barge.

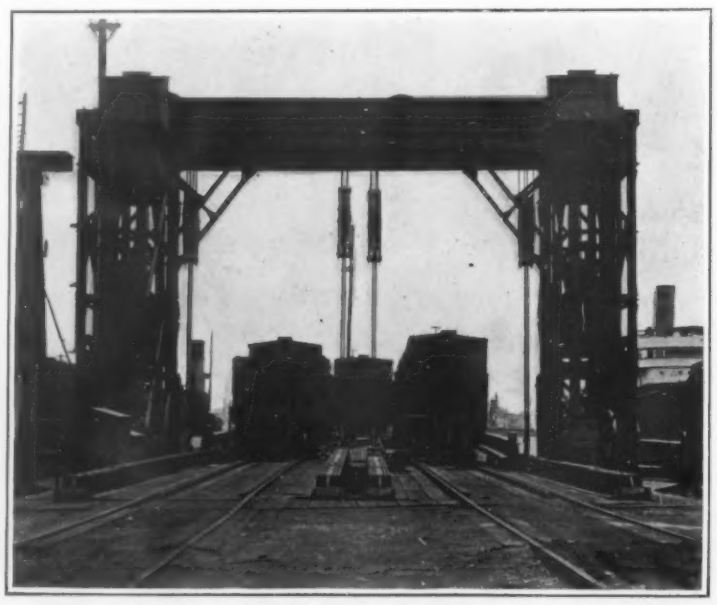
Heretofore the steel construction of transfer-bridges has been virtually impossible. It invariably happens that during the process of loading or unloading, one side of both bridge and barge is weighted down, while the other is "light." This necessarily causes the bridge to be warped and twisted transversely.

The Baltimore bridge, as constructed, consists of two single track through-plate girders, with one span supporting each track. The land end of these girders is hinged around a 5-inch pin, and the outer end is suspended by an overhead structure. By this arrangement the load is transferred from the bridge to the dead-load counterweight by means of wire cables. A system of pick-up counterweights overcomes the settlement, which would naturally result from the coming onto the span of the live load, and which would submerge the land-end of the barge and lift the outer end from the water. There are two 1⅝-inch cables extending from the bottom of the dead-load counterweight around the sheaves. These cables are fastened to the sheave-blocks and form a fixed relation between the sheave and the dead-load counterweight. If the latter is raised or lowered, the sheave is raised or lowered in a like degree.

From the pile of pick-up counterweights a wire cable is run up over one sheave and down around another and up into the machinery house atop of the structure, at which point it is attached to a drum. The bridge is operated by electric motors located in the machinery house. To overcome the listing of the barge to the loaded side thereof, two tilting heads have been provided. To these, which are pinned at the center, so that they may be revolved in a vertical plane about the 15¼-inch pin, the barge is attached by toggle-bars.



The system of counterweights.



Baltimore's car-ferry.

**A Patent for a Street Railroad Transfer Ticket.**—Inventions involving the arrangement of printed matter upon a page or sheet of paper are always difficult to define and distinguish in a patentable sense. The case of Cincinnati Traction Company v. Pope, decided by Circuit Judge Knappen of the Sixth Circuit, in sustaining the Pope patent for a time limit transfer ticket holds that a patentable invention is disclosed, and that the term "manufacture" as used in the patent law has a very comprehensive sense, embracing whatever is made by the art or industry of man, not being a machine, a composition of matter, or a design. The defendants argued that the patent relates merely to a method of transacting business, a form of contract, a mode of procedure, a rule of conduct, a principle or idea, or a permissive function predicated upon a thing involving no structural law. It was urged that "the ticket in question has no physical characteristics which enable it to be distinguished from any other transfer ticket or from any other printed slip of paper." The Court, after referring to the case of Rand, McNally & Co. v. Exchange Scrip-Book Company, said that the language of Judge Grosscup seemed particularly applicable, wherein the judge said: "The ticket patented is not a method at all, but a physical, tangible facility without which the method would have been impracticable, and with which it is practicable." The Court also quoted the language of another Judge, who said, "The fact that the structure may be of cardboard with printed matter upon it does not exclude the device from patentability according to the Patent Office."

## RECENTLY PATENTED INVENTIONS

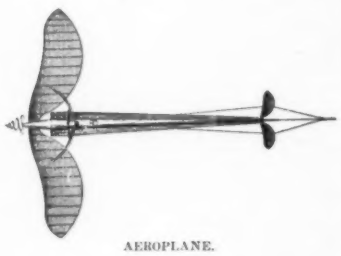
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

### Pertaining to Apparel.

BUCKLE.—J. F. DUNN, New York, N. Y. The object of the present invention is to form a buckle for belts, the construction whereof is simplified and cheapened. This construction in its simplicity and openness of structure lends itself readily to any desired form or finish, such as plating, lacquering, or similar processes.

### Pertaining to Aviation.

AEROPLANE.—H. MANSON-OLIN, 414 Union St., Brooklyn, N. Y. An object here is to provide an aeroplane having rigid supporting surfaces disposed one above the other. Another is to provide an aeroplane having laterally extending wings maintainable rigidly in a horizontal plane, and capable of rotation in this plane, whereby the device may be automatically stabilized. A further object is to provide an aeroplane having automatic stabilizing devices coacting with steering and balancing devices.



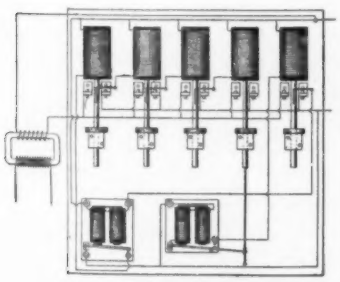
AEROPLANE.

### Electrical Devices.

ELECTRICAL FITTING.—M. F. FINKELSTEIN, 84 Walker St., New York, N. Y. This device is for use in connecting the ends of wire or like conductors, and comprises an insulating body, conductor-receiving and holding means within the body, means for electrically connecting the conductors, and a guard for the last-mentioned means, movable longitudinally of the device, into an operative and into an inoperative position.

ELECTRIC FITTING FOR CIRCUIT WIRING.—M. F. FINKELSTEIN, 84 Walker St., New York, N. Y. This invention provides a fitting which can be fashioned from different materials adapted for the purpose, which is susceptible of a variety of uses, by means of which electric conductors may be readily and securely connected, by means of which the electrical connection effected is an excellent one, and which can be easily manipulated.

AUTOMATIC STARTING BOX.—M. E. CUSTER, Box 14, Carbonado, Wash. Mr. Custer's invention relates to automatic starting boxes of the kind used in connection with electric cars or other electrically driven machinery, or with electric lamps for the purpose of first causing a small flow of current through the main or power circuit, and then increasing the flow step by step until the current reaches its normal or working power.



AUTOMATIC STARTING BOX.

### Of Interest to Farmers.

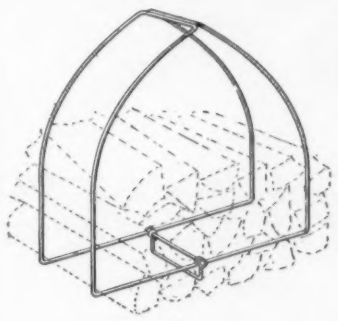
BULL STAFF.—W. T. SHERMAN, Peru, N. Y. This invention provides an inexpensive and reliable device with which a bull may be easily and safely conducted. It consists of a longitudinal member with a hook at one end and a handle at the other. A spring latch normally closes the gap of the hook, and a chain running from the latch to the handle provides means for opening the gap when desired.

BULL STAFF.

BUNDLE SUPPORTER FOR THRESHERS.—P. POWERS, Carlisle, Neb. The invention refers to self-feeders of threshing machines, and particularly to an attachment adapted to be applied to self-feeders of known make whereby to support the bundles at the lower end of the self-feeder, and provided with means for adjusting the width of the attachment to suit different self-feeders.

### Of General Interest.

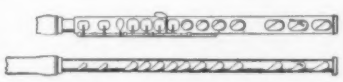
CARRIER.—J. NILSON, R. F. D. No. 2, Box 65, Clearbrook, Minn. This invention relates more particularly to a carrier especially adapted for use in handling sawed and split wood in order to avoid the necessity of carrying such wood in the arms, and thus filling the clothes with dirt and splinters. In use the carrier is partially filled with the wood or like articles, resting on the straight lower portions of the frames, as shown in the engraving, and confined between the upstanding side portions of these frames.



STOVE WOOD CARRIER.

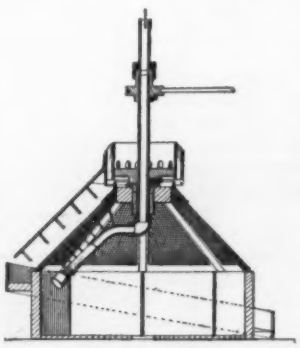
WOOD WIND INSTRUMENT.—N. ALBERTI, 2227 Bissell St., Chicago, Ill. An object of this invention is to provide means for tuning wind instruments, such as flutes, clarinets, and the like. A further object is to provide means for simultaneously changing the pitch of the notes produced by the opening of the different valves. The mechanism is simple and is not liable to get out of order like those instruments in which valves are put into or out of commission, and a new set of valves is used.

WOOD WIND INSTRUMENT.—N. ALBERTI, 2227 Bissell St., Chicago, Ill. This invention provides means for tuning wind instruments, such as flutes, clarinets, and the like. There is in use what is known as "concert pitch" and "international pitch." Many times musicians are obliged to make use of both, or are compelled to transpose the music, which is difficult; or some have instruments of different pitch which necessitates carrying an extra instrument. Moreover, instruments such as flutes or clarinets are often used with pianos whose pitch varies from true to international pitch. The purpose here is to provide a device which may be quickly tuned to any pitch.



WOOD WIND INSTRUMENT.

SCREEN.—E. A. WOOD, P. O. Box 96, Gem, Idaho. An object of the invention is to provide a device by means of which fine ores may be treated preparatory to concentration in a manner which effectually and economically prepares the ores for their subsequent treatment. The invention provides a device which may be used in lieu of a hydraulic classifier in which the separation of the ore constituents may be made at a more rapid rate than with the ordinary hydraulic classifier.



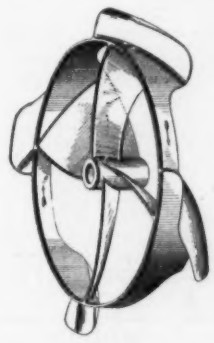
ORE SCREEN.

CONDENSER FOR ZINC VAPORS.—M. APPEL, Johnstown, Pa. This device is designed to be used preferably with an electric furnace for condensing the zinc vapors which are driven off by the furnace. The condensation takes place through the medium of air or gas-cooled tubes in which the flow of air or gas can be easily regulated.

AUTOMATIC MULTIPLE NOTE HORN.—E. TESTE, 18 Rue des Bois, Paris, France. The air distributer is provided with several series of openings capable of being brought opposite the trumpets and so arranged that the sounds successively emitted will produce a complete musical phrase or a number of them. The operation of the air distributer is by a spring-pressed pawl jointed to a metal collar adapted to rotate on the distributer when the bulb is compressed and to act on a ratchet-wheel keyed to the distributer at the time the air enters the bulb. Means provide for arresting the air distributer. The construction permits of either entirely stopping the emission of sound or of producing a uniform sound.

ENVELOP.—C. G. GLOVER, 101 Laurel St., Watertown, Mass. This inventor provides a mailing envelop with an extending flap for the stamp, the blanks from which the envelops are manufactured being of such a shape that they may be cut economically from a sheet of material. The envelop, as stated, is constructed with a flap on which the stamps may be affixed in such a manner as to facilitate the cancellation of the stamps.

PROPELLER.—J. F. WOODYARD, 1221 Murdock Street, Parkersburg, W. Va. The invention provides an improved propeller adapted for use in water or air as well as in windmills and electric fans. The propeller consists of a hub and a band with four blades running from the hub to the band, two of the blades, as shown in the illustration, being broader than the other two, and hence acting as main blades. The design of the blades is such as to give a straight line running quartering from the cutting edge of the blades, while the band holds the water, making it take the grade, thus causing a better end thrust and less slip than is ordinarily experienced. On the opposite side of the bands are buckets which operate to catch more water from the outside as the wheel revolves, thus giving greater power or end thrust to the wheel.



PROPELLER.

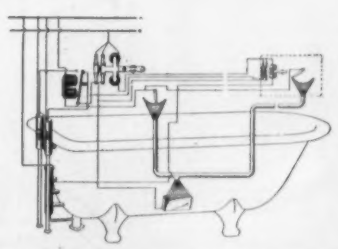
### Hardware and Tools.

BARBER'S SHEARS.—W. H. TOURJÉE, Factoryville, Pa. The main object of the improvement is the provision of a pair of shears, the use of which will obviate the painful fatigue to certain muscles of the hand and wrist which would occur when the ordinary barbers' shears are used. In using the ordinary type of shears the wrist is generally twisted so that the extensor ossis metacarpi pollicis, extensor pollicis, and extensor longus pollicis muscles are often affected. The invention remedies this by allowing the hand and wrist to rest in a perfectly natural position.

BARBER'S SHEARS.

### Household Utilities.

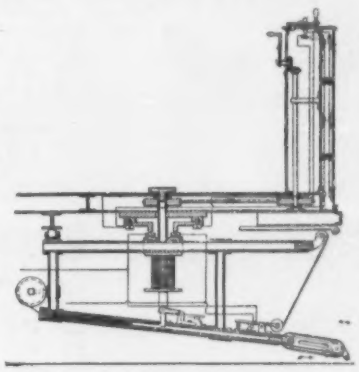
AUTOMATIC WATER TEMPERATURE CONTROL SYSTEM.—F. R. GERHARDT, Monsey, N. Y. This improvement relates to means for controlling a flow of water into bath tubs, wash basins and other receptacles, and has particular reference to means associated with hot and cold water supply pipes whereby an operator at any desired position, either adjacent to the receptacle or remote therefrom, may, by simple adjustment of an indicator and the pressing of a button or the like, initiate the automatic control and flow of the water at any desired temperature.



AUTOMATIC WATER TEMPERATURE CONTROL SYSTEM.

### Railways and Their Accessories.

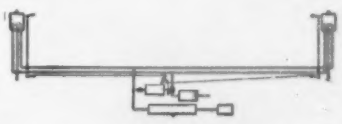
AUTOMATIC CAR FENDER AND SAFETY BRAKE.—B. PÉDUCASSE, address N. Delorme, Ridgewood, N. J. This invention relates to an automatic fender for electric cars or other fast-moving vehicles, parts of which are adapted to be automatically extended by the impact of the body of the person in the way, so as to readily pick up said person with the least possible injury, and, at the same time, to automatically set the brakes of the car so as to bring it to a stop in the shortest possible lapse of time.



AUTOMATIC CAR FENDER AND SAFETY BRAKE.

CROSS TIE.—G. F. BROCKWAY, R. F. D. 4, Box 76, Eden, Iowa. This improvement relates to railroad ties, and more particularly to a tie designed to embody all of the good points of the ties now in use with the added security of greater strength, rigidity, and structural changes to obviate rail spreading and tie bunching.

EMERGENCY AIR-BRAKE DEVICE.—J. H. MACLEARY, 405 Bayard Ave., Wilmington, Del. An object of this inventor is to provide a device by means of which a street car or the like may be controlled even if an accident should happen to the main reservoir or the line leading therefrom, or even to the pump which supplies the main reservoir. A further object is to provide a device comprising an auxiliary air reservoir in which the air may be stored under pressure, and which ordinarily is not in communication with the brake cylinder, but which may be brought into communication with the brake cylinder should occasion arise.



EMERGENCY AIR-BRAKE DEVICE.

### Pertaining to Vehicles.

PERMUTATION LOCK.—C. A. WEHNER, 420 Habershane St., Savannah, Ga. This lock is for use with automobiles, and is arranged to alternately connect a source of electrical energy with a motor to start the same and with the magneto, wherein the lock is normally prevented from movement by releasable mechanism, operated by a selection from a plurality of push pins of a series, wherein the selection of push pins may be varied to provide for changes in the combination, and wherein the changing mechanism is normally locked in inactive position and may be released only by operating the proper selection of push pins.

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NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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## The Opening of the Cape Cod Canal

(*Concluded from page 112.*)

the shipper and the vessel owner, and in abolishing this burden the canal will confer a benefit that will be widely felt.

Appreciating its great commercial value, as many business men must have done, it is rather incomprehensible that the cutting of the Cape Cod Canal should have been delayed so many years, and the only explanation seems to be that those who investigated the matter in recent years were probably too strongly impressed and frightened by the ancient reports of engineers who based their opinions on primitive methods that have been entirely superseded by modern machinery and extended experience in later undertakings. It is, therefore, greatly to the credit of the intelligence and enterprise of the individuals who have successfully carried to a conclusion this much discussed project, and thanks are due them for a public improvement of widespread value.

## The Unloading of Coal

(*Concluded from page 117.*)

in providing a means for the return of the empty cars. They do not necessarily come back on the same track. Here we have gravitation helping in the operation of the pier. This idea of a gentle grade is applied in several different ways in accordance with the surrounding conditions. In some cases, it has seemed necessary or advisable to employ a steep grade in connection with a gentle one. The explanation of this is to be found in part in the necessity to get the cars ultimately to a high level above the water. That is to say, the tracks at the point of discharge should be from 33 to 43 feet above the level of the highest hatches of the vessels at mean tide. As gravitation is to do the work of carrying the coal from the bins to the ship, there must be sufficient drop to enable this to be done, and at the same time accomplish a horizontal reach. The steep grade may, if it is not too steep, be overcome by the use of ordinary locomotives. In other cases, where space does not permit a long approach, the grade may have to be so steep as to require the use of a cable and barney.

Some of the piers are very long. The very longest are in New York harbor. Thus at South Amboy, N. J., the Pennsylvania Railroad has a pier 1,800 feet long. The same railway has one at Harsimus Cove, N. J., which is 1,750 feet in length. The Central Railway of New Jersey has two piers 1,600 and 1,700 feet in length, respectively, at Port Liberty, N. J., which may be used from both sides. But none of these piers have any very especial capacity, despite their great length, except that at Harsimus Cove, which is capable of discharging 300 cars per day of ten hours.

One object in view in introducing special machinery into plants which deliver coal to vessels is to save space. That is the reason cars are mechanically pushed up steep inclines instead of gentle ones. The plants which depend most upon mechanical arrangements are all located in the ports of New York and Philadelphia, where the price of land is presumably at the highest level. The Pennsylvania Railroad has two such installations at South Amboy, N. J., in New York harbor and one at Greenwich in Philadelphia harbor. Apart from minor differences, all these are operated upon the following plan. The car loaded with coal is received by a cableway, which takes it up a short steep incline to a "cradle." This is a movable framework, big and strong enough to receive and hold fast the car and its load. The cradle and car are then lifted and overturned sideways with the result that the load is spilled into a large apron. The carload of coal, say forty tons, runs or flows down the face of the apron into a chute, to the mouth of which the sides of the apron converge. Once in the chute, the coal is guided to the point in the hold at which it is desired finally to dump it. From the moment the car is overturned, the coal flows under the influence of gravitation alone. The apron may be raised and lowered, and the chute may be dis-

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GLANCE at this picture for three seconds. Put it aside. Write down what you saw on this table. (You can try it by having someone put objects on your own table.) If you don't get all the objects exactly right, your observation isn't 100 per cent. efficient—and you may be losing money, pleasure, health, because of it. And Observation is only one of the things you've got to be Efficient in to win in this strenuous day. All that you know. But you didn't know, perhaps, that the time has come when you can learn to be Efficient, just as you might learn business, or law or medicine, through a

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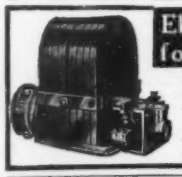

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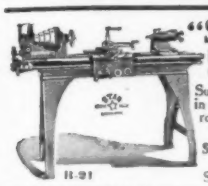

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posed in a variety of ways. The empty car returns to the yards by gravity. Power is employed in this plant (1) to get the loaded car up the steep incline into the cradle; (2) to lift the cradle and car vertically; and (3) to overturn the whole. The car is taken up the incline and the vertical lift is made in order to get a sufficient elevation above the vessel to enable gravitation to complete the work. The Baltimore and Ohio Railroad has a plant of this kind at St. George, Staten Island, and the Delaware, Lackawanna, and Western Railroad has two at Hoboken, N. J., all three in New York harbor. The latter railroad has another mechanical plant at Hoboken in which the coal when dumped is received by a hopper. An endless chain conveyor takes the coal from the hopper and elevates it to a considerable height, from which it flows down into elevated bins. From the bins it flows down through chutes, finding its way at last into the hold of the vessel.

In a number of cases on the Atlantic coast, the plants delivering coal to vessels consist of a combination of the pier and mechanical appliances. Of the four new plants now under construction, two belong to this combination variety, and one to the excessively mechanical type. So that the trend seems in the direction of mechanical methods. In Norfolk harbor, that is, at Lamberts Point and at Newport News, two of the biggest plants are being constructed for the Norfolk and Western Railroad and the Chesapeake and Ohio Railroad. The piers in both cases will have a length of 1,200 feet. They will be operable from both sides. The height above the water in both cases is something over 91 feet. The daily capacity of either will be 600 cars of bituminous coal. Either pier will be equipped with more than 60 chutes. When they are completed, Norfolk harbor will have a total daily capacity of 3,180 cars, making it the second greatest coal harbor on the coast. These plants will operate by means of a car dumper, an elevator, and an incline for the return of empties. The railway car with its load will first be run up a short incline into the cradle of a dumper. The contents will then be dumped into a special dock car. This car will be carried up the elevator to the deck of the dock. It will then move out on the dock by gravity or under its own individual power to the point where it discharges its load into the pockets and chutes of the pier. When empty, the dock car will be returned down a steep incline under the control of its brakes. These two plants will be the leaders of all those operating on the Atlantic seaboard.

## German Artillery in the War

*(Concluded from page 116.)*

while that on either side is an air reservoir. The recoil brake differs from the type adopted in connection with field guns. The gun is not connected to the brake cylinders, but to the piston rod. Consequently, it is the piston rod and the piston which move in the recoil of the gun, the brake cylinder remaining stationary. The air reservoirs consist essentially of an air cylinder, a ram with piston rod and piston, and valves.

The howitzer fires a shell weighing 136 pounds, and the charging of the weapon requires the aid of six or eight men, the explosive charge weighing 38 pounds. By using one of eight different charges, it is possible to vary the initial velocity from 590 to 1,115 feet per second. It is possible to secure, with all distances exceeding 7,218 feet a falling angle for the shell exceeding 22 degrees. The weight of the projectile is more than twice that of the next most powerful weapon of its class, while its range is 20 per cent higher.

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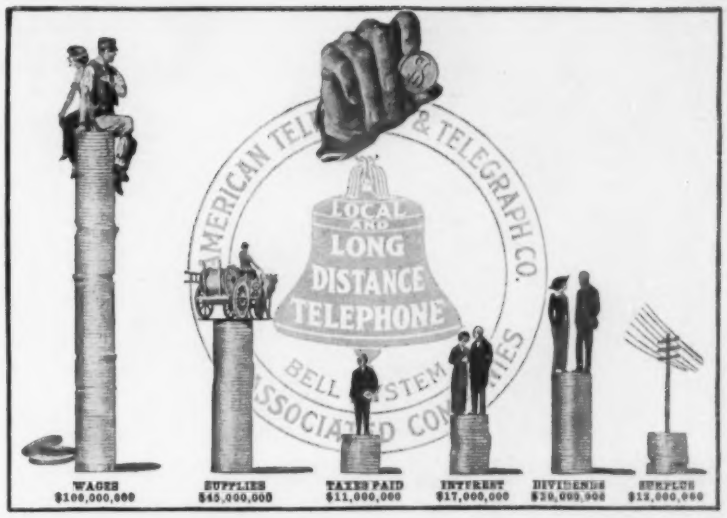


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**Tax Collector—$11,000,000**
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**Bondholders—$17,000,000**
Paid in interest to thousands of men and women, savings banks, insurance companies and other institutions owning bonds and notes.

**Stockholders—$30,000,000**
70,000 stockholders, about half of whom are women, receive $30,000,000.
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**Surplus—$12,000,000**
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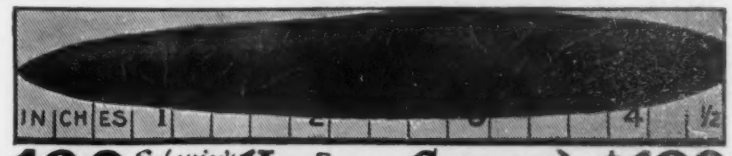


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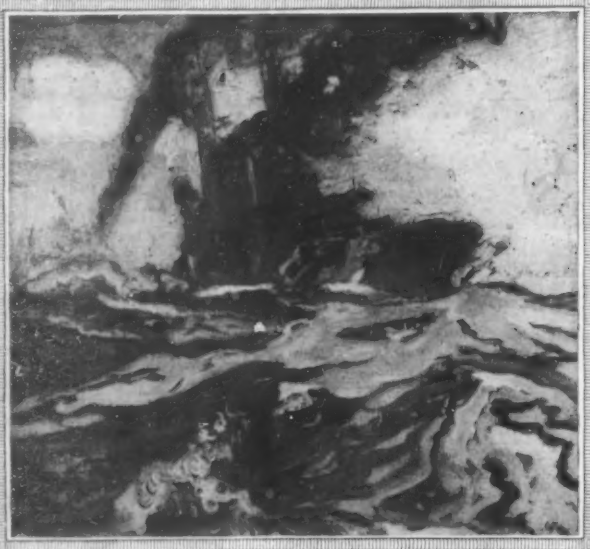

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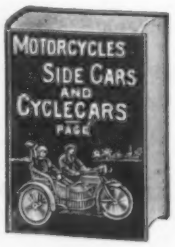


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